NATURE

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RECONSTRUCTION AND PLANNING

A NOTEWORTHY illustration of the strength of the national morale is the widespread interest taken in post-War reconstruction. The immediate task of the Ministry of Works and Buildings in speeding up the erection of buildings needed for the war effort is generally taken for granted. It is the contribution of the Ministry to the building of the world we shall live in after the War that captures the popular imagination.

It is somewhat surprising, therefore, that so little attention has been given in the Press to the Conference on National Planning held by the Garden Cities and Town Planning Association at Oxford on March 28–30. However much it may be necessary to postpone the physical reconstruction until after the War, it is essential that the principles upon which our policy is to be based and by which action is to be guided should be elucidated and defined as early as possible, even if only in view of their bearing on the wise direction of our war effort—as, indeed, the Select Committee on National Expenditure has hinted. A summary account of some of the papers appears on p. 684 of this issue of NATURE.

Research is equally important on particular questions and on those involving general policy and principles. This point was well made by Major E. Maxwell Fry in a recent address to the Housing Centre on "Research on a Plan for London". A town-planning scheme must be the result of research into the elements of living, which must be organized in the most efficient manner. The problem in London is concentrated in the provision of good housing, opportunities for adequate leisure and healthy work-places, linked together by efficient transport services. These four elements—work, leisure, housing and transport—are interdependent and form the basis of the problem.

Investigation on the general and on the particular questions must clearly proceed simultaneously if we are to be prepared when the full opportunities arise after the War. Moreover, there are matters in which action may be required during the War to prevent the growth of further obstacles to central development and effective local planning. To some of these attention was directed by Sir Ernest Simon in a paper before the Conference on National Planning on urban land-ownership and management after the War, and Lord Samuel, in a reference to the same subject, welcomed a statement in the House of Lords by Lord Brocket, chairman of the Land Union, that the Union is ready to welcome reasonably devised measures for bringing the use of the land into conformity with the interests of the nation. To problems such as compensation and betterment the Uthwatt Committee is already giving attention, and it may well be hoped that Lord Reith will take action in time to prevent private interests in the devastated districts or elsewhere creating obstacles to developments required in the public interest.

The further attention directed to these matters by the Conference on National Planning is warmly to be welcomed, and the fresh support forthcoming for national planning should at least lead to fuller consideration of the recommendations of the Royal Commission on the Location of Industry.

There are undoubtedly limitations on the extent to which effort can be expended in these directions during war-time. It is all the more important, therefore, that the more restricted opportunities should not be missed. The discussions at Oxford

are supplemented by Mr. Ritchie Calder in his Democratic Order Pamphlet No. 5, the theme of which is that we should start planning Britain now. The essential thing is that, as Mr. W. H. Ansell, president of the Royal Institute of British Architects, urged in his paper on "The London of the Future" before the Royal Society of Arts on March 12, we should clarify our general principles and think about those principles before proceeding to particular planning. Too often in the past the thinking has followed the planning, or rather the lack of planning. The immediate urgency is the preparation of the plan in order that when peace comes upon us, it shall not find us unready, and in consequence rebuilding of our cities and factories take undesirable forms.

Mr. Ansell's paper alone is an inspiring picture of possibilities in the planning and rebuilding of London—the redistribution of industries, the re-planning of traffic, of docks and markets, the restoration to the City of something of the glory lost by its congestion, the preservation and encouragement of community areas or the creation of new ones, the re-planning of commercial areas and the architectural opportunities in scientific and fire-resisting reconstruction—possibilities which in varying degrees are inherent in the planning and reconstruction anywhere necessitated by devastation through bombing. The vision of possibilities, when fortified by the determination to use our opportunities, can supply steadiness in the dark days of ordeal which may yet lie ahead, and the stimulus to co-operation in the work of reconstruction, with something of the national unity and energy at present displayed in our war effort.

Several aspects of planning are referred to in two Democratic Order series of pamphlets referred to below*. Mr. Calder ranges concisely over the whole field, indicating mistakes and confusion in the past, the present position, not merely of the Ministry of Works and Buildings, but also of planning and location of industry as resulting from the Barlow Commission inquiry, the weakness of local and regional authorities, and the opportunities and problems which have already been thrown up by the War. With many of these scientific workers are familiar, but Mr. Calder surveys them with a lucidity which should bring home to every citizen the vital need for some definite policy and national planning.

* The Democratic Order. No. 1: What are we waiting for?: a Call to Britain. By Francis Williams. Pp. 64. No. 5: Start Planning Britain Now: a Policy for Reconstruction. By Ritchie Calder. Pp. 64. (London: Kegan Paul and Co., Ltd., 1941.). 1s. net each.

Mr. Calder shows, too, how this question of planning and reconstruction is linked up with the development of social services, particularly with questions of nutrition and medical service, and the tremendous demands it makes on the intelligent use of our resources on scientific lines, whether in such matters as standardization, transport, or the interlocking of agricultural and other industries, food policy and nutrition, and the effect of changes in the age structure of our population upon housing and educational needs and policy. National planning is, in fact, more than the peace aim on which Mr. Calder insists. It is a vital part of our war effort and one of the ways in which we can, as Mr. Francis Williams argues, in "What are we waiting for?", make democracy not only something to fight for but something to fight with. A determined effort to deal now with the question of planning and all that is involved in working out the lines of policy, not just for physical reconstruction but also for the social and economic reconstruction needed, would give us a most effective weapon for the overthrow of the slavery masquerading throughout the greater part of Europe as the Nazi "New Order".

There are indeed welcome signs that this is increasingly recognized by the Government itself. The whole tenor of Lord Reith's recent statement in the House of Lords was coloured by the assumption that the principle of planning would be accepted as national policy, and that a central planning authority would be established. He has shown himself, further, to possess large and comprehensive views and to be alive to the need for further investigation. The examination of conditions in Birmingham, Coventry and Bristol and the wholehearted support given to the work of the National Buildings Record are sufficient example. The personnel of the Consultative Panel on Reconstruction already announced by Lord Reith has commanded widespread approval; indeed, the chief concern at the present moment is that whatever plans are finally accepted should be consistent with the principles that administrative control should not be divided and that the planning authority should have power to put its policy into effect.

This is the main argument of two admirable articles which have recently appeared, one entitled "Problems of Reconstruction. I. Building", in the *Round Table* of March, and the other by Mr. Thomas Sharp on "Planning for Reconstruction" in the *Political Quarterly* of April–June. Both

point to the dangers inherent in the large number of Government departments concerned and the imperative need for co-ordination and for the handling of the main groups of problems by specially constituted ministries or sub-ministries, untrammelled by departmentalism. Lord Reith's own Ministry of Works and Buildings is the only example so far of the kind of special department required, and whether or not the present Ministry is expanded into a Ministry of Planning and takes over other functions from the Ministry of Health, War-time Communications, Agriculture, the Central Electricity Board, the Forestry Commissioners, the "National Industrial Board" recommended by the Barlow Commission and the National Park Commission recommended by the National Parks Committee, if the present opportunity is to be used some authority must be given power to plan all post-war land now, and to initiate the bold measures which will make possible the successful execution of a post-war building programme embodying the new approach to social problems involved in the planning of a new and better society.

A scheme suggested in the *Round Table* visualizes the Ministry of Works and Buildings as supreme authority and including four distinct sections. The first of these is the lineal descendant, much expanded, of His Majesty's Office of Works, which, among other functions, might exercise the required control over building and stimulate the far-sighted statesmanship on the side of employers and trade unions required in planning boldly several years ahead. The second is a long-term planning organization concerned with the location of industry and with town and country planning, exercising many of the functions recommended in the Minority Report of the Barlow Commission, including the functions and powers transferred from the Ministry of Health, the former Ministry of Transport and the Commissioners for the Special Areas. This division would co-ordinate the long-term building projects so that too much is not attempted in any one year, but the detailed planning and execution of the building programme of the whole country, both civil and Governmental, would be entrusted to a programme department. Both these departments would work in close contact with a National Investment Board and the National Housing Board.

Besides these three divisions, a housing division is suggested which would take over most of the present housing functions of the Ministry of Health and supervise housing finance through the National Housing Board. The latter would be a purely financial institution, the nucleus of which might well be formed by the building societies; but by accepting responsibilities of landlordship, it would be able to compel builders to accept high standards of design and workmanship. The division would supervise the quality of the houses built and enter into direct relations with the local authorities in respect of the programmes carried out by them.

A centralized plan of this character does not mean the imposition of local building programmes from above. Only national requirements should be planned at the centre. Regional and local details within the national plan should be planned regionally through a series of regional planning commissions, but some one department must deal with all land-using activities if the waste of land and its misdirection from the purpose which best serves the public interest, whether by the speculative builder, the industrialist or the Forestry Commissioners, is to be stopped. Administrative power in a democracy must remain in close contact with the people, their welfare and their desires.

These thoughtful articles are no less insistent than Mr. Francis Williams, in his lively and provocative "What are we waiting for?", that the start on such planning must be made now, and that we must not allow the attempt to be hampered by the professional tradition or outlook of the Civil Service. Nor need we despair, even with the present demand for man-power, of allocating a proportion to prepare us to meet post-War problems. Obviously some thought is already being given to these matters by the Government. Regional geographers, sociologists, economists, architects and town-planners may be reasonably expected to pay attention to these problems even in war-time.

There should indeed be no insuperable obstacles to the marshalling at the present moment of an effective proportion of the trained intelligence of the nation to the formulation of policy and plans to prevent hindrances to reconstruction developing during the War, as well as scramble, confusion and improvised plans and decisions to meet demands for action which will urgently and insistently arise when the War ends. Only by foresight, coupled with constructive imagination, clear thinking and unflinching loyalty to sound administrative principles throughout the present days of war, can we ensure an adequate recompense after the War for all the sufferings and hardship we have already faced or may still be called upon to endure.

RELATION OF CRIME TO NATION AND RACE

Crime and the Man

By Earnest Albert Hooton. Pp. xvi+403. (Cambridge, Mass.: Harvard University Press; London: Oxford University Press, 1939.) 21*s*. 6*d*. net.

The American Criminal

An Anthropological Study. By Earnest Albert Hooton, with the collaboration of the Statistical Laboratory of the Division of Anthropology, Harvard University. Vol. 1: The Native White Criminal of Native Parentage. Pp. xvi+309+482+15. (Cambridge, Mass.: Harvard University Press; London: Oxford University Press, 1939.) 56*s*. net.

IN 1938, when Prof. E. A. Hooton had completed a survey of the bodily features of American criminals and compared them with observations made on corresponding samples of 'unconvicted' civilians, he was invited by the Lowell Institute to give lectures on the harvest he had reaped. These lectures have been published as a book under the title "Crime and the Man"; they give a clear and almost joyous account of a survey of the prison population of ten States, which occupied more than twelve years, included upwards of 17,000 individuals and involved the tabulation and statistical treatment of about 2½ millions of measurements and observations. The criminals and their civil 'control' samples fall into four groups: (1) native whites born of parents who were also born in the United States; (2) native whites born of immigrant parents; (3) white immigrants; (4) citizens of African—or mainly African—origin. Each of these groups is to receive full descriptive and statistical treatment in a separate publication issued by the Harvard University Press under the title "The American Criminal: An Anthropological Study", of which the first volume has now been published. It contains 309 pages of text and 482 pages of tables; vol. 2 will deal with groups 2 and 3; while vol. 3 will deal with the African group.

Prof. Hooton speaks of the publication of this great three-volumed work as "a manifestation of an incredibly non-commercial policy", while the publisher, with equal modesty, claims that "so far as known it is the most extensive anthropological study of criminals ever made". As to preceding works of this nature—why! there is only "The English Convict", published in 1913 by Dr. Charles Goring, in comparison a minor work, of which, by the way, Prof. Hooton, in his outspoken way, passes both praise and blame. I am more sanguine than either author or publisher as to the merits and future of this work. Apart from giving proof that there is a correlation between type of criminal and type of crime, and between race and crime, as well as between nationality and crime, Prof. Hooton deals in its pages with principles which lie at the foundation of anthropological investigation of the living and has opened up important side-lines of inquiry and so produced a work which should be in the library of every anthropologist.

First, let me mention briefly some of the more important of the "side-lines". Prof. Hooton was surprised to find, after he had assembled his data, that each State had its own prevailing anthropological types. There is thus already at work in the United States a tendency to produce local breeds of humanity, due, as Prof. Hooton suspects, to the isolation and inbreeding of the original settlers of the various areas. Students of human evolution, who regard isolation and inbreeding as the main conditions necessary for the development of separate breeds and races of mankind, herein receive encouragement.

Another of the side-line inquiries relates to the process of 'Americanization', namely, that children of immigrants, born in the United States, undergo not only a cultural but also a transformation of body in the land of adoption. There are many, besides the reviewer, who viewed with scepticism the claims made by Prof. Franz Boas that children born to Italian parents in America differ in head form, and in many other statistical details, from the original Italian stock. Scepticism is no longer possible, for Prof. Hooton's statistical inquiries confirm those of Prof. Boas. Of the various nationalities, the Italians undergo the greatest degree of physical Americanization. With such inquiries it is pertinent to compare those made by Dr. H. L. Shapiro[1] on Japanese born in Hawaii. This observer found that the Hawaiian Japanese differed statistically from the immigrant Japanese and these, in turn, differed from the folk in Japan from which they had been drawn. How we are to explain such environmental transformations I do not know, but it is plain that all three of Dr. Shapiro's groups remained unmistakably Japanese.

When he sought to trace the relationship of race to crime, Prof. Hooton had to assign 5,689 white American criminals to one or other of the racial stocks of Europe. He found only 106 that could be classified as purely Nordic in characterization, 145 pure Alpine and 252 pure Mediterranean. Thus only 9 per cent of the total number of criminals were assignable to the three racial divisions into which the majority of anthropologists separate Europeans. Even if we add a

fourth division, namely, the Polish or East Baltic, which Prof. Hooton regards as a pure race, there still remained 88 per cent of the prison polulation of America which were unassignable to pure breeds and had therefore had to be placed in mongrel categories. Herein we see a justification for those who maintain that the only living races in Europe are such as are demarcated by national frontiers.

To repel such a suggestion Prof. Hooton might well cite the fact that he has proved that there is a closer relationship between his racial types—nine in number—and a tendency to crime, than there is between national groups and their predisposition to crime. Further, he has found that the kinds of crime to which his small and pure racial groups are prone are more sharply characterized in body than is the case in the larger mongrel groups. Thus the evidence justifies Prof. Hooton's contention that there is a relationship between a criminal's conformation of body and his tendency to commit criminal or anti-social acts. We note, too, that he expects to find a relationship of racial type to social behaviour.

Coming now to the main theme of Prof. Hooton's survey we note that he emphatically rejects the existence of a single representative type of criminal man. He finds that each form of crime—of which he recognizes ten kinds or groups—draws preponderatingly from a civilian group which possesses certain physical characters, as well as social qualities, so that each kind of crime has its own physical type of criminal.

This review has touched only on the fringe of the harvest reaped by Prof. Hooton during the twelve years he spent in a statistical purgatory. His observations on the physique of the insane, on the Negro—in jail and out of jail—his zeal for reform in the treatment of criminals, his forays into eugenics, his attacks on the wrong gods of democracies—all of these have to be passed by with a mere mention. But enough has been said of these two books to tempt anthropologists to study them and, I have no doubt, to profit from them.

A. KEITH.

[1] "Migration and Environment", 1939. Reviewed by Prof. Wood-Jones. NATURE, July 29, 1939, p. 177.

PRESENT-DAY AERIAL WARFARE

(1) Defence Against the Night Bomber
By Noel Pemberton-Billing. Pp. 191. (London: Robert Hale, Ltd., n.d.) 2*s.* 6*d.* net.

(2) The Military Aeroplane
By E. Colston Shepherd. (Oxford Pamphlets on World Affairs, No. 44.) Pp. 32. (Oxford: Clarendon Press; London: Oxford University Press, 1941.) 4*d.* net.

(1) THE reviewer, when reading this book, was reminded of one of his old professors who was always insistent upon his students never becoming too fantastic in their scientific ideas. He used to say that if he was asked to build a bridge across the Straits of Dover, for the benefit of travellers prone to sea-sickness, as an engineer with a knowledge of the theory of structures he would reply that it was not "impossible", but as a man of the world he would say that it was entirely "impracticable". To use the term "impracticable" is not an unfair criticism of the author's ideas for dealing with night bombers. Remembering his many-sided experience, including some in practical aeronautics, one wonders just how much of this book was written with his tongue in his cheek. For example, his suggestion for covering the country with a mantle of light which would not only blind the raiders but reveal them to the night fighters above them, is logical, and sounds fascinating. But where is all the apparatus, the men to manipulate it, the electrical power, or even the coal to produce it, coming from? It is already obvious to even a lay observer that man-power in the factories is going to be one of the decisive factors in this War.

His prospect of towed fighters sounds good until one asks where all the fuel is to be found, and how collisions are to be avoided. To be effective, a constant patrol over the whole of the country, relatively closely spaced, would have to be maintained. Would not the same amount of fuel consumed, and labour necessary to build and maintain such a fleet, be better expended in preventing the enemy from building bombers by flying over and blowing up his works?

Incidentally, one does not have to understand the technicalities of aeronautics to appreciate the fact that as the R.A.F. so thoroughly smashed the daylight attacks upon Great Britain, the principal problem remaining is to give a night fighter apparatus with which he can detect an enemy machine in the dark. He has already shown himself capable of doing the rest. Upon this problem the book is discreetly silent.

Stimulating reading, as any contact with Mr. Pemberton-Billing always is, but a serious contribution to the scientific aspect of the problem of night defence, No!

(2) This book, No. 44 of the Oxford Pamphlets on World Affairs, is the second written by Mr. E. Colston Shepherd upon matters aeronautical. The other, No. 28, was entitled "Britain's Air Power". These pamphlets are intended to be short, concise explanations of affairs that are necessarily the province of the specialist, written in such a manner that they appeal to the ordinary reader. This volume certainly maintains the high standard of these publications and is well worth reading by those not familiar with the war developments in aviation. It is written in a restrained style, unclouded by the author's personal opinion too often, and presents the situation to-day, written by one who obviously knows much more than he thinks it politic to say in print.

The author explains the meaning and duties of the different types of war machines: the fighter, long-distance fighter, bomber, precision bomber, dive bomber, torpedo carrier, reconnaissance aircraft and army co-operation machine. He then discusses their possible developments and their limitations from the points of view of both their design and use. He finishes with a general discussion upon probable future developments, a dangerous procedure at any time, and particularly so when those developments take place under the stress of war-time demands. At least one of his prophecies has come true since it was written: "The Tornado fighter with its new Vulture Engine should have a speed of more than 400 m.p.h." His whole summing up is exemplified in one of his sentences, with which we must all agree, "Both sides are striving above all for more speed", and if he had added greater range or armament carrying capacity, he would have stated the case even more completely.

THE ULTRA-PERCEPTIVE FACULTY

Exploring the Ultra-Perceptive Faculty
By Dr. J. Hettinger. Pp. 172. (London: Rider and Co., 1941.) 12*s.* 6*d.* net.

IN this book Dr. Hettinger, whose previous work on the so-called ultra-perceptive faculty has already been noticed in NATURE (Feb. 22, p. 217), gives an account of further experiments in the same field, which he has devised partly in order to satisfy the need for a method of inquiry which, he thinks, may enable the faculty to be demonstrated at will.

For this purpose a person is first asked to set his watch at a time prearranged with another person or 'sensitive', who may be at any distance from him—in this case several miles. He is then asked to look slowly for about one hour at some illustrated periodical, reading any short articles that may be of interest and glancing at the illustrations, while noting down the times at which the various items were seen. At the other end the 'sensitive', in company with the experimenter, makes a series of statements which come into consciousness, the only link with the subject at a distance being some object or other belonging to the subject, this article being placed within reach or under the hands of the 'sensitive'. The experimenter then notes what is said by the 'sensitive', jotting down the times of the various statements at intervals of about one minute to correspond with the intervals noted by the subject when reading the periodical.

It is claimed that when the statements made by the 'sensitive' are compared with, for example, the illustrations seen by the subject, close approximation, both in time and subject-matter, is often established in a number of instances. Thus when the subject was looking at a photograph of a large horse, the 'sensitive' was saying, "Some admiration for large cart horses"; and when the subject had a picture of a camera before him the 'sensitive' was saying, "A large camera and bright light". In both these cases and in many others no time lag is claimed, the times being almost, if not quite exact.

Although at first sight the results of these experiments may appear both striking and impressive, it would seem that Dr. Hettinger might have done better to delay publication until he had attempted a much closer and more detailed analysis of his results. In this report he has not printed a single one of the full statements of a 'sensitive' in any one case, a record clearly desirable if the value of the items given is to be properly appraised. Moreover, Dr. Hettinger seems to have been somewhat too complacent when dealing with some of his results which, he thinks, can be accepted without applicable statistical checks and corroborative testimony by independent witnesses. How far he is right in this surmise remains to be seen. Suffice it to say that these findings are certainly of some interest; but it would seem that much work remains to be done and many control experiments devised, before it can be stated with any degree of confidence that here again we have solid evidence that some form of ultra-perceptive faculty has been fully established.

E. J. DINGWALL.

The Anodic Oxidation of Aluminium and its Alloys

By Dr. A. Jenny. Translated by Winifred Lewis. (Griffin's Technological Handbooks.) Pp. vii + 231. (London: Charles Griffin and Co., Ltd., 1940.) 16*s*. net.

THE protection of aluminium and its alloys by anodic oxidation is so important a process that it now constitutes an industry of itself, requiring a specialized literature. This is the first text-book to be produced for the anodic oxidation specialist, and its design to satisfy his needs results in what might at first appear to be a peculiar mixture of chemical, electrical and electro-chemical theory. It is divided into two main parts, the first being devoted to basic electro-chemistry, the chemical properties of aluminium and its alloys, the valve effect at aluminium anodes, and the anodic oxidation process. The second part deals with more practical aspects, such as operating details, the properties and applications of the films produced by different techniques, sealing and dyeing of the films, and chemical protective processes. Brief particulars are also given of the reflector processes and the "Seo" photo process.

One or two criticisms of detail may be made; aluminium does *not* form a useful protective film in chloride solutions (p. 63) and may be very seriously attacked by anhydrous stearic acid in the absence of air (p. 64); and many readers in Great Britain will be disappointed by the limited attention given to the Bengough–Stewart process. Nevertheless, the book must be recommended to all interested in the protection of aluminium alloys.

H. W. G. H.

Wayside and Woodland Trees

A Guide to the British Sylva. By Edward Step. Revised by A. Keith Jackson and A. Bruce Jackson. Pp. xxxviii + 186 + 175 plates. (London and New York: Frederick Warne and Co., Ltd., 1940.) 9*s*. 6*d*. net.

A NEW edition of this well-known work is very welcome, especially in view of the fact that it has been revised by A. K. Jackson of Kew Herbarium and A. B. Jackson of the British Museum (Natural History). Yet we do not like either of the two most outstanding features—the colour photography is attractive but misleading; and what a pity Mr. Henry Irving's superb photographs of trees in winter and summer are not placed on opposite pages. Since they are printed on art paper and inserted, this might have been difficult though not impossible. The authors' claim that this means of making a striking comparison is "rather novel" is not true. It has been done before, but nevertheless it is a great asset to any book on trees.

All trees indigenous to Great Britain are portrayed and described; so also are some exotics which have become established in these Islands. There are two pictorial keys—one based on leaf character in summer, the other on bud character in winter. These, together with the beautiful photographs and the clear and accurate line diagrams and descriptions will make it almost impossible to come across a tree and fail to identify it.

Surface Tension and the Spreading of Liquids

By Dr. R. S. Burdon. (Cambridge Physical Tracts.) Pp. xiii + 85. (Cambridge: At the University Press, 1940.) 7*s*. 6*d*. net.

DR. BURDON'S short treatise can be heartily recommended as a clear, and very concise, account of most of the principal phenomena involving liquids and their interfaces with gases and solids. The methods of measuring surface tension, and the details of spreading of liquids on liquids (including spreading on mercury, to which the author has made notable contributions) are treated in considerable detail; contact angles, with several of their important technical applications, are also described in detail; there are short but sound and clear sections on the relation between intermolecular forces and capillary phenomena, and on monolayers on water. Lubrication and adsorption are also touched upon. The treatment is non-mathematical, only a few formulæ being given.

The book is up to date, and, though brief, manages to convey a surprising amount of information in small compass, references to larger treatises and to original papers being given where necessary. The author usually gives the substance of accepted theory, without, however, sacrificing a pleasing directness and originality of treatment. The book differs from some of the Cambridge physical tracts in being less an account of specialized work in a restricted field than a short introduction to a wide group of subjects, but it should prove very useful.

N. K. A.

Animals in Action

By Dr. Gayle Pickwell. (Whittlesey House Publication.) Pp. xii + 190. (New York and London: McGraw-Hill Book Co., Inc., 1940.) 24*s*.

THIS new book by Prof. Pickwell is similar in format to his three previous publications which, chiefly owing to their superb illustrations, have become well known among naturalists in Great Britain. Again, therefore, must we welcome an admirably produced work, with a stimulating text and sixty-eight arresting plates, most of them single photographs, 9½ in. × 7½ in.

The whole of the animal kingdom is covered, and the subject-matter is considered under the following main headings: general review; animals at home; animals as parents; animals growing up; animals getting food; animal protection; animals getting air; animals getting about; animal kinds; how to know animals.

The author is professor of zoology in the San José State College; but this book makes it clear that he is not only a teacher but also a lover of animals and a master of the technique of photography. The book would certainly broaden the vision of students of zoology or biology (usually so tied down to the examination 'type' system), and it would be treasured by any professional or lay natural historian. Thus it would make a suitable prize or present which could scarcely be surpassed by anything produced on similar lines in Great Britain.

SOYA BEAN CULTURE IN GREAT BRITAIN

By DR. H. H. MANN,
WOBURN EXPERIMENTAL STATION, BLETCHLEY

IS it possible to grow soya beans successfully, on a commercial scale, in Great Britain? There is no doubt that if this culture could be established, a most valuable addition to our agricultural resources would be made, for the soya bean is one of the most valuable of the world's oil seeds, besides being capable of many other uses. Yet, except for a relatively small area in Canada, none of it is produced within the British Commonwealth.

At its maximum, the world's production of the bean was estimated at fifteen million tons[1]. The largest grower is China, though in that country almost the whole of the output is consumed as human food. It is Manchuria whose production dominates the world's oil seed market, and there the area in 1937 was nearly nine million acres. In recent years, the United States has entered the front rank of soya bean producers, and now, apart from the very large area on which the crop is simply cultivated for its fodder value, between two and three million acres are grown for seed purposes and a substantial export trade has been built up. Its cultivation as a source of oil has also extended very largely into the Balkan countries, chiefly into Rumania and Bulgaria, where the area before the War was not far from three hundred thousand acres, and into the U.S.S.R., where at its maximum (1931) the crop covered more than a million acres, though this has since been very much reduced[2].

With such large developments of a crop which had formerly been almost a monopoly of northern China and Manchuria, it was natural that interest in its possibilities in Great Britain should have arisen, and for a good many years rather casual experiments in its culture have been undertaken. The chances of success appeared to be considerable. In comparison with most other oil seeds, it has the advantage that it grows commercially under much more temperate conditions than other sources of vegetable oil, and, further, the seeds are a source of a very tasty human food (being, in fact, originally imported as a condiment), while the oil cake forms a rich animal feeding-stuff as well as a good fertilizer. The dearth of home-produced oil seeds at the present time would make, in fact, any considerable extension of the crop a matter of national importance.

All early experiments, however, indicated that most of the available types of soya beans would be of no use for seed production in Great Britain[3]. If planted early in the spring, they were ruined by late frosts. They usually ripened so late in the autumn that the seed often went mouldy on the plants before it was ripe, even if the plants fruited at all. Though it seemed possible that there might be a few varieties that could be grown for seed production in Great Britain, the bulk of those cultivated in the more favoured countries proved themselves definitely unsuitable to British conditions.

Attempts have been made, at least since 1914, to select such suitable varieties, and the work of J. L. North at the old Royal Botanic Society's gardens in Regent's Park resulted in the production of types, several of which ripened in September or the beginning of October. These included a brown type which North called 'Brown *C*', and a group of different coloured kinds which he termed 'Jap'. Further, W. Southworth, previously of the Manitoba Agricultural College, settled at Rothamsted in 1932, bringing with him a type derived from the well-known American soya bean 'Ogemaw' and some others, and under his general supervision several of these and North's also have been grown almost every year since then at Rothamsted and Woburn.

The results of these trials with some of the most promising types in existence have not been encouraging for the prospects of the soya bean as a commercial crop. It seems, in fact, to demand three conditions which we cannot give in full measure in Great Britain. In the first place, being rather sensitive to frost, it cannot be sown until serious danger in this direction is over. In 1935, for example, I sowed several varieties on April 25, and a spell of cold weather in May, accompanied by frost, severely checked the early growth though it did not kill the plants. All the varieties I used seemed to be affected. There is clearly danger, except in the extreme south of England, in sowing before the end of April, and this substantially reduces the length of the possible growing season.

Even more important is the second condition demanded by the plant. The soya bean crop seems to require a 'continental' summer, that is to say, a period of higher temperature while it is growing than we can let it have in Britain. Sir John Russell has recently compared, for example[4], the mean monthly temperature during the growing

season at Kleinwanzleben (where soya beans have been successfully grown) and at Rothamsted, with the results shown in the accompanying table.

Mean Temperature (Fahrenheit)

	April	May	June	July	Aug.	Sept.
Kleinwanzleben	48·3	53·9	61·3	66·1	65·6	59·8
Rothamsted	44·8	52·5	56·2	60·4	59·4	55·7
Difference	3·5	3·4	5·1	5·7	6·2	4·1

It is this additional warmth that enables the more continental climate of Kleinwanzleben to grow soya beans better than Rothamsted. The same result is brought out if we compare the length of the growing season of certain known varieties. For example, the variety 'Mandarin' is stated by Piper[8] to ripen in 100 days : at Woburn it took 171 days to give me ripe seed. The variety 'Manitoba Brown', reputed to ripen in 85 days, took, with me, 144 days. All these figures would seem to tell the same tale, namely, that summers in Great Britain are not warm enough for the generally used types to give the best results. In summers that have been wet and sunless, such as that of 1936, we were scarcely able to ripen any seed even of the most successful varieties either at Rothamsted or at Woburn.

Thirdly, the time of ripening should not be later than the first week of October, and preferably the last week of September. If later than this, with the wet autumns that are a feature of the British climate, the chance of drying the ripened crop so that it can be stacked or threshed is small. In the year 1935, for example, I was able to reap the variety 'Manitoba Brown' on September 21, and got it in good condition. The later variety 'Mandarin' was only cut on October 21, yet at this date the beans were not thoroughly ripe, but rather soft.

In spite of these difficulties, certain varieties have been successfully cultivated in a series of years. Recently, Dr. H. Hunter of the National Institute of Agricultural Botany at Cambridge has pointed out that he has got two varieties, namely, 'Brown *C*' and 'Jap', which have a tolerable chance of ripening in Great Britain. Our results entirely agree with his, both at Rothamsted and at Woburn. The 'Jap' types, however, though they have certainly ripened, are very feeble growers. The Brown type, which we call 'Manitoba Brown', but which seems to be identical with Hunter's *'C'*, has done better, and in most years since 1934 I have been able to get a normal ripening of good seed, though with a much longer growing season than is customary in Canada, from which country the seed is derived.

But I have never been able to get a yield of seed comparable with what seems to be usual in Manchuria, in the United States, or elsewhere. The yield, in fact, recorded in Manchuria, Japan and the United States runs about 15 cwt. per acre, whereas I have not been able to get more than a maximum of about 6 cwt. per acre of clean seeds. In the course of my trials, I early found that soya beans would not grow at all well unless the land were at least of average fertility. The common idea that the crop can be grown on poor land and reliance placed on its leguminous character to obtain large healthy plants when nitrogenous matter is deficient in the soil is incorrect. Now, I always use soil which has been well manured with farmyard manure some months before planting, and, in 1940, I also used a small dressing of sulphate of ammonia at the time of seeding. But, in spite of this, as already stated, I have never been able to get a large yield. My best was 635 lb. of clean seed per acre in 1938, with the 'Manitoba Brown' variety. Other types which have ripened successfully at Woburn have been 'Black Jap', 'Green Jap', and one obtained from Japan by Southworth called 'Tokio Brown'. All these were less luxuriant than 'Manitoba Brown', and certainly were not earlier. None of them gave me more than 300–400 lb. per acre, the 'Black Jap' being the best.

In order to reach even this yield, the seed was sown between April 25 and May 15. In an average season, probably about the first week in May is the best time. I have always dibbled the seed in rows eighteen inches apart, the dibbles being from six to nine inches apart in the rows. For a non-luxuriant type like all those mentioned, this is probably, if anything, too wide seeding. I have never had any difficulty with germination, but the young plants are very attractive to all sorts of vermin. If growth is normal, the flowers appear on the lower parts of the plants about the middle of July. In 1940, I noticed them on July 22, and flowering was continuous from that date. On August 9 there were clusters of pods on the lower part of the stems and very small pods on the upper parts. When the crop is ripening, the leaves all fall off, and, when ripe, there are practically clean stems with the pods on them. The varieties with which I have been successful have ripened at the end of September, and they were then cut, spread to dry, and, when dry, were at once threshed.

A yield such as I have obtained is not encouraging for the development of a commercial soya bean culture. In spite of the fact that the seed contains between 16 and 20 per cent of oil (of which it is usually counted that 15 per cent is commercially recoverable), and that it has certain other advantages such as its tasty character, it would, at present, pay better to grow the ordinary field bean unless the yields I have obtained can be increased very largely. This small yield in conditions obtaining in Great Britain has, up to

date, discouraged even the most enthusiastic growers.

The possibilities for the future seem to depend on the development of types which yield more heavily in our climate than any of those tried hitherto and which are still early enough to ripen at least by the first week in October, and on finding cultivation methods which give again a larger yield than those I have hitherto adopted. I am not unhopeful of the chances in both these directions, but a very great deal of work will be required before the cultivation of the soya bean can take a large part in ordinary farming practice even in the south of Great Britain.

[1] Empire Marketing Board. Publication E.M.B./C./4. (1932).
[2] Imperial Economic Committee. "Vegetable Oils and Oilseeds" (1938).
[3] See Russell, E. J., *J. Min. Agric.*, **43**, 24 (1936).
[4] *The Times*, March 12, 1941.
[5] Piper, C. V., "The Soybean", p. 167, New York (1932).

PROBLEMS OF THE MOTIONS OF SOLAR PROMINENCES

By M. A. Ellison

YEARS of great solar activity, like those of 1937–38, stand out as landmarks in the advance of our knowledge concerning the phenomena of the solar chromosphere. The quantitative study of prominence motions is little more than twenty years old and derives the greater part of its observational material from the peak years (1926–27 and 1937–38) of the last two solar cycles. Indeed, the recent studies by Max Waldmeier[1] with the spectrohelioscope suggest that at times of maximum activity great eruptive prominences occur on the average about once a day somewhere in the solar chromosphere. They may form the normal, though dramatic, end-phase in the life of every quiescent prominence.

Because of their great size and amazing speed, the eruptive prominences have been more extensively investigated than those of the other four main types; yet we are still without an acceptable theory which will explain, even qualitatively, the characteristic and well-marked stages in their life-history. They originate in all solar latitudes, and show no preference for the sunspot zones, where either the intense magnetic fields of the spots or the occurrence of chromospheric eruptions, emitting ultra-violet radiation, might provide a satisfactory basis for a theoretical discussion of their movements. As an example we may quote the case of the great prominence of September 17, 1937, whose "crowded hour of glorious life" was photographed at the McMath-Hulbert Observatory. This rose in 80 minutes to a height of 1,000,000 km. above the sun, attaining at the end of its trajectory a maximum speed of 728 km./sec. It must be admitted that this is a record for such objects in speed, though not in height; it forms the only example, certainly observed, of matter leaving the chromosphere with a speed in excess of the escape velocity of 617 km./sec. It is a thrilling moment for any solar observer when a quiescent prominence, perhaps 100,000 km. in length, begins to rocket upwards in the field of the spectrohelioscope; and within the past few years these events have been made visible to a wider audience by the superb films of solar phenomena which we owe principally to Dr. B. Lyot of Meudon, and Dr. R. R. McMath and his co-workers in America.

Observations of eruptive ascents were first collected together by Dr. Edison Pettit, of Mount Wilson Observatory, in a celebrated series of papers[2]. His catalogue now includes some fifty examples for which the photographic records are sufficiently complete to enable height-time diagrams to be plotted. On the basis of the earlier observations the following laws of motion were formulated:

Law 1.—The motion of a portion of a prominence or of a prominence as a whole measured along its trajectory is uniform, increasing suddenly at intervals as if by impulse.

Law 2.—When a change of velocity takes place, the new velocity is a small whole multiple of the old. Occasionally the *last* velocity is a whole multiple of the second previous.

Concerning these two laws there has been much controversy, and they have undoubtedly provided a great stimulus to research. Dr. McMath observes: "To say that these curious laws of prominence motion are mysterious is very definitely an understatement. They contradict every known law of the motion of particles under the action of a gravitational attracting centre; it is as though acceleration in prominences functioned only in 'definite acceleration quanta' "[3]. The nature of this motion is illustrated in Fig. 1, which may be regarded as being typical of the height-time diagrams for eruptive prominences. The initial upward velocity of 10–50 km./sec. is represented by the constant gradient AB. Sudden changes of velocity occur at points like B, C where the abrupt

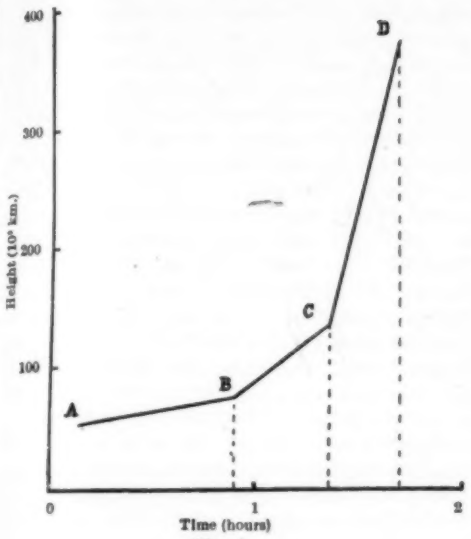

Fig. 1.

changes of gradient (*Knickstellen*) indicate velocity increases which (according to Pettit) are small whole multiples of the original. It has been shown that these changes occur in periods of less than 1 minute and that they are separated by intervals which tend to become progressively shorter as the prominence rises. As many as five such changes have been recorded in a single ascent.

The earlier records were obtained exclusively by photography with the conventional type of spectroheliograph in light of the *H* and *K* lines of calcium or $H\alpha$ of hydrogen. The usefulness of this method of following rapidly changing structures was limited by the need for long exposure intervals of 4 or 5 minutes; short-lived changes were lost and measures of height became insufficiently frequent. A great advance was therefore made in 1933 by Dr. McMath[4], who combined a standard motion-picture camera with the visual spectrohelioscope developed by G. E. Hale, leading at once to the possibility of more rapid and automatic operation. So successful were these preliminary experiments with the spectrohelio-cinematograph that they were followed very soon by the building of the 50-ft. tower telescope and automatic spectrographs of the McMath-Hulbert Observatory[5], Lake Angelus. Difficult technical problems had to be overcome, such as the provision of a precision drive to the 22-in. cœlostat mirror which would keep the image of a prominence fixed at a definite point in the film frame throughout the day, and the construction of timing and exposing devices.

With the completion of this powerful unit in 1937, it became possible to obtain as many as one thousand pictures a day of a single prominence, exposures being of 10–30 sec. with a 'dark-time' of a few seconds in between. The films have been shown in Great Britain before the Royal Astronomical Society and also during the Cambridge meeting in 1938 of the British Association. When they are projected in the usual way at 16 frames per second, there is a speeding up of the original events by about 500 times, from which one may gain a remarkable insight into these weird and complicated movements. One result has been to confirm what was first pointed out by H. W. Newton[6], that the downward movements greatly predominate over the upward, and several new types of prominence have been added to the existing classification. Of these, perhaps the most puzzling are the so-called 'coronal prominences', consisting of matter which first becomes luminous at heights of 250,000 km., or thereabouts, and then pours down in slender columns into centres of attraction in the chromosphere. The downward movements are usually unaccompanied by any visible upward flow to sustain them.

For purposes of measurement, the cinematograph pictures were projected on to a ground-glass screen, 20 cm. × 25 cm., from which the distances moved by selected knots or streamers could be read off along suitable scales. It then became possible to extend the work to the movements of other types of prominence, in particular the class III, or spot-type, of the Pettit classification, with results which, it was claimed[7, 8], demonstrated that all obeyed the two laws of motion. This conclusion has been challenged by H. R. Hulme[9], who bases his criticism upon an analysis of some of the space-time diagrams for descending matter drawn by McMath and Pettit. He shows that these are composed of points which might equally well be fitted by smooth curves rather than by straight lines, and concludes that "the second law is unfounded, and that the application of the first law to the case of descending streamers is not yet justified".

Undoubtedly one of the great causes of uncertainty in this work arises from the fact that the photographic records are two-dimensional. However uniform may be the movement of a prominence streamer along its own trajectory, its velocity will not appear uniform if the plane containing the trajectory is steeply inclined to the normal plane; and it is here that the spectrohelioscope, used for visual observations of the chromosphere and prominences, has proved of great value. In this instrument the Doppler effect can be utilized in a simple way to measure the line-of-sight velocity of prominence features on the sun's limb, or when seen projected as dark hydrogen absorption flocculi on the disk. Waldmeier[1] has thus been able to obtain a three-dimensional picture of the

movements of some of the eruptive prominences observed at Zurich, and he concludes that the second law of Pettit does not hold for the eruptives. The direction of future advance would therefore seem to rest with the possibility of developing a technique for the automatic recording of line-of-sight velocities in such a manner that they can be combined with those obtained from the two-dimensional photographs. Furthermore, when prominences are observed with the spectro-helioscope and are seen as absorption markings projected against the solar disk, curves may be plotted between the line-of-sight velocity and the time. Near the centre of the disk, if the prominence is moving vertically in the chromosphere (as may often be demonstrated by the absence of simultaneous lateral movements), the velocity-time curve will give a true picture of its motion[10].

The remarkable films taken by Dr. Lyot differ from those of the American workers in being direct photographs of solar phenomena. Through superior technique, Lyot has achieved success[11] in this direction where earlier attempts conspicuously failed; and he has been able to develop the coronagraph, in which instrumental diffusion of light has been reduced to a minimum. With such an instrument situated in the clear air of the Pic du Midi, 9,000 ft. above sea-level, photographs of prominences may be taken through suitable filters on many days of the year. In one important respect the method is superior to the use of the spectroheliograph; for the absence of any narrow selecting slit (inherent in the spectroheliograph) allows a record of prominence streamers with high radial velocities to be obtained at the same time as those with little or no radial velocity. The general agreement between the two methods is therefore most satisfactory, since it indicates that radial velocities of 100 km./sec. or more, which would shift the image right off the second slit of the spectroheliograph, are comparatively rare in ordinary prominences.

Numerous attempts have been made to provide a theoretical basis for the first law of motion, bearing in mind the nature of the forces which atoms in varying degrees of excitation may experience in the chromosphere. At the very least we must take into account the effects of gravitation, light-pressure, magnetic fields and frictional resistance.

An attractive starting-point is to assume that in the chromosphere and prominences gravity is balanced by light-pressure; calculations of the magnitude of the light-pressure indicate that this is so, though it must be admitted that we are not sufficiently certain of the processes involved to be assured of the result. In any event, if such an equilibrium does exist, it must be expected that the Milne effect will frequently intervene to upset it. Milne[12] proposed that when a prominence began to rise by reason of some small local disturbance in the chromosphere, its absorbing line would shift to the violet in consequence of Doppler effect; here it would encounter the much more intense continuous spectrum with corresponding increase in light-pressure. A condition of instability would be the result, the prominence continuing to rise with *accelerated* velocity. Pettit and McMath[8] have worked out in detail the consequences of this instability, taking into account the known contours of the *K* and *H* absorption lines, and have shown that it would lead to a height-time diagram which is a continuous curve, quite unlike the observed movements of the eruptive prominences. Moreover, the great difference in masses of the atoms of hydrogen and calcium should tend to produce a considerable separation of these gases during the ascent. This has never been observed; indeed the spectroheliograms taken by light of the two different wave-lengths have always shown the images to be remarkably alike.

K. O. Kiepenheuer[13] has considered the motion of prominence material to be expected in the magnetic field of a sunspot, and he arrives at a result for the knots and streamers of class III (sunspot-type) prominences which indicates uniform motion. He finds also that the motion of the eruptive prominences is consistent with the supposition that their atoms receive energy intermittently by absorption of ultra-violet radiation, having its origin in frequent chromospheric eruptions. Against this must be recorded the fact, demonstrated both by Pettit and Waldmeier, that the change-over from one uniform velocity to the next in an eruptive prominence occurs in a period that does not exceed one minute, while the average duration of observed chromospheric eruptions is about twenty minutes. Furthermore, the chromospheric eruptions are very definitely confined to the sunspot zones, while the eruptive prominences are not.

It is evident that a workable theory for prominence motions is one of the great needs in solar physics to-day.

[1] Waldmeier, M., *Z. Astrophys.*, **15**, 299 (1938).
[2] Pettit, E., *Astrophys. J.*, **50**, 206 (1919); **76**, 9 (1932); **84**, 319 (1936).
[3] McMath, R. R., *Proc. Amer. Phil. Soc.*, **79**, 4 (1938).
[4] McMath, R. R., and Petrie, R. M., *Pub. Univ. Michigan Observer*, **5**, 103 (1933).
[5] McMath, R. R., *Pub. Univ. Michigan Observer*, **7**, 1 (1937); NATURE, **146**, 287 (1940).
[6] Newton, H. W., *Mon. Not. Roy. Astro. Soc.*, **94**, 472 (1934).
[7] McMath, R. R., and Pettit, E., *Astrophys. J.*, **85**, 279 (1937).
[8] McMath, R. R., and Pettit, E., *Astrophys. J.*, **88**, 244 (1938).
[9] Hulme, H. R., *Mon. Not. Roy. Astro. Soc.*, **99**, 634 (1939).
[10] Ellison, M. A., in course of publication.
[11] Lyot, B., *Mon. Not. Roy. Astro. Soc.* (George Darwin Lecture), **99**, 580 (1939).
[12] Milne, E. A., *Mon. Not. Roy. Astro. Soc.*, **86**, 459 (1926).
[13] Kiepenheuer, K. O., *Z. Astrophys.*, **15**, 53 (1938).

SPECIFICATIONS FOR NATIONAL FLOUR

THE Accessory Food Factors Committee of the Lister Institute and the Medical Research Council, in a memorandum issued in the summer of 1940, recommended the adoption for bread of a flour of 80–85 per cent extraction of the wheat, in the following terms: "Flour for the bread of the people should contain the germ of the wheat grain, as much as possible of the aleurone layer, and the finer portions of the bran. Instead of flour consisting of about 70 per cent of the wheat grain, as it does at present, the percentage extracted should be at least 80 to 85 per cent".*

Since this recommendation was made, the Ministry of Food has decided to make generally available to the public bread baked from flour of 85 per cent extraction.

In the original memorandum the nutritional considerations on which the recommendation was based were set out. It now seems desirable to re-state them, incorporating the results of further research and defining more exactly the character of the particular 85 per cent extraction flour recommended by the Committee.

Special Nutritive Properties of the Selected Flour

The degree of extraction was fixed at 85 per cent in order to secure a flour which should contain:

(1) As much as possible of the B vitamins including riboflavin and nicotinic acid and especially of vitamin B_1, present in the whole wheat.

(2) As much protein as possible, including a high proportion of that situated in the outer layers of the grain. This protein is known to possess a higher nutritive value than that contained in white flour.

(3) As little bran as possible so that there should be no risk of loss of nutritive value due to presence of much indigestible material. War-time diets already contain much vegetable food with relatively large amounts of roughage; it is undesirable to increase this further.

Production of Flour of 85 per cent Extraction

Flour of 85 per cent extraction can in practice be obtained by two general methods: (1) by re-arrangement of the milling machinery to produce a flour containing 85 per cent of the wheat, or (2) by addition to the white flour (73 per cent extraction), obtained in the ordinary milling processes, of combinations of the other fractions of the wheat.

The consideration which has influenced the final selection of the flour to be adopted has been the need to combine two qualities: first, the best nutritive value and, secondly, the production of a loaf as little removed as possible in colour, texture and flavour from that of ordinary white bread. Two flours, prepared respectively by the above methods (1) and (2) were selected as possessing equal nutritive value, the first, however, being preferable as fulfilling the second condition most perfectly. Flour (1) was selected as the best for the following reasons:

(*a*) Of all flours obtained at the same level of extraction by different methods from the same grist, it had the highest vitamin B content and in this respect closely approached that usually accepted for wholemeal bread.

(*b*) It had the lowest fibre content compared with other flours extracted at this level from the same grist.

(*c*) Of all the breads tested, baked from 85 per cent flour, it yielded the one which resembled white bread most closely in flavour and texture.

(*d*) The colour of the bread was pale brown and was not unattractive.

(*e*) On technical and on æsthetic grounds the loaf baked from it was considered excellent.

Definitions for two Selected Flours

Flour (1).—This straight-run flour may be defined as a flour containing 85 per cent by weight of the clean wheat, in which is included (*a*) the maximum amount of the germ and of the aleurone layer and (*b*) the minimum of the pericarp, as shown by its low fibre content.

Flour (2).—May be defined as (*a*) containing 85 per cent of the weight of the clean wheat grain in which is included all the white flour, all the reduction roll tails, mill finish and purifier tails and sufficient fine bran to bring the amount of the mixture up to 85 per cent of the clean wheat; (*b*) containing 85 per cent of the clean wheat and excluding 15 per cent consisting of the bran and pollards.

Analyses of samples of flours (1) and (2) are set out in the accompanying table below, with those of white flour of 73 per cent extraction and of wholemeal flour, all four materials being derived from the same grist (water content being 15 per cent).

Samples of flours (1) and (2), obtained from the same grist, were found to be similar in content of protein, ash and vitamin B_1, which in both cases was more than 1 I.U. per gm. (thiochrome methods). The fibre content of both flours was less than 0·9

*See also NATURE, **146**, 117 (1940).

Flour	Fibre %	Ash %	Protein %	Vitamin B_1 International Units per gm. (thiochrome method).	Calcium mgm. %	Phosphorus mgm%	
						Total	As phytic acid.
1 (85%)	0·60	0·90	11·4	1·2	27	203	123
2 (85%)	0·85	0·94	11·5	1·15	27	211	128
White (73%)	0 to 0·20	0·46	10·6	0·35	15	101	35
Wholemeal (100%)	1·8	1·51	11·9	1·4	36	343	246

per cent that of flour (1) being lower than that of flour (2). The lower the fibre content the better is the flour and the more efficient is the milling.

Keeping Properties

No exact evidence is as yet available regarding the keeping properties of the particular types of flour selected, but from the experience gained of other brown and wholemeal flours there is little doubt that this flour of 85 per cent extraction could be kept in good state under reasonable conditions of storage for 4–6 weeks or longer.

Recommendation 1

The Accessory Food Factors Committee, at its meeting on January 23, 1941, recommended that a flour of 85 per cent extraction (similar to flour (1)) should be adopted.

Since modification of ordinary milling machinery would be required for production of flour (1) and this would take time, it was further recommended that a flour of 85 per cent extraction (similar to flour (2) should be adopted in the meantime, as this could be produced without any delay. The flour should not contain less than 1 I.U. vitamin B_1 per gm. and the fibre should be less than 0·9 per cent (assuming a water content of 15 per cent).

Addition of Calcium Salts

It is known that the intake of calcium salts in the diets of Great Britain, especially among the poorer classes, is frequently below the minimum accepted by nutrition experts as necessary for satisfactory growth of bones and teeth in growing children and for maintenance of the bones in adults. The addition of calcium salts to bread was recommended in the previous memorandum issued by the Medical Research Council. It is now possible to add details concerning the amounts required.

Wholemeal bread and bread made from flour of 85 per cent extraction contain more calcium than white bread and also more phosphorus. A large proportion of the phosphorus, however, is present in a combination (phytic acid) in which it is not directly available to the organism and at the same time diminishes the availability of the calcium present in the bread and in the rest of the diet. Recent tests made on human subjects for the Medical Research Council have shown that to maintain a sufficient supply of calcium salts for health more calcium salts must be added to the diet. The most convenient way to do this is to add calcium carbonate to the wheat flour used for bread. As a result of the above tests on human subjects who consumed about one half of their total calorie intake as bread with only small amounts of milk and very little cheese, it has been calculated that additions are needed of 65 mgm. calcium per 100 gm. white flour (7 oz. of calcium carbonate as *creta præparata* B.P. per 280-lb. sack) and of 130 mgm. calcium per 100 gm. flour of 85 per cent extraction (14 oz. calcium carbonate per sack). In the case of the 85 per cent extraction flour the extra 7 oz. per sack is required to neutralize the effect of the extra phytic acid contained in flour of this degree of extraction.

It has long been a practice in baking to add similar amounts of substances known as 'improvers' (for example, acid calcium phosphate 12 oz. per sack, or up to 4½ lb. per sack, in case of certain self-raising flours at present on the market).

The addition of the recommended amounts of calcium carbonate to flour has no effect on the vitamin B_1 content of the flour or on its baking properties.

Recommendation 2

It is recommended that calcium carbonate (as *creta præparata* B.P.) should be added to the wheat flour from which white bread is made in the proportions of 7 oz. per sack (280 lb.) of white flour and of 14 oz. per sack of 85 per cent extraction flour.

Addition of Iron Salts

The desirability of adding iron in some form to flour has been considered, the reason being that anæmia due to insufficient iron in the diet is common in Great Britain and could easily and cheaply be prevented by administration of simple ferrous salts. A study of the available data on this subject has, however, led to the conclusion that the presence of added iron salts in flour might cause destruction of some of the other nutrients present. It is, therefore, not recommended that any such additions be made until further knowledge on this point is available.

Addition of 'Improvers'

The addition of certain 'improvers' to bread baked from flour of high extraction facilitates the work of the baker and results in a more attractive loaf. Such evidence as is available does not justify at this stage the prohibition of their use in the baking industry and the question has therefore been left open.

OBITUARIES

Sir Albert Seward, F.R.S.

WE regret to record the death of Sir Albert Seward on April 11 at the age of seventy-seven. Albert Charles Seward achieved outstanding success as an investigator, a teacher, a writer and an administrator. Most of his life was spent in Cambridge, where the University and two of its colleges owe much to his untiring energy, but his work also extended over a much wider field and few scientific men have been so widely known and so universally popular.

Born at Lancaster in 1863, he was educated at Lancaster Grammar School and St. John's College, Cambridge, of which he was three times a fellow. From his school days he was devoted to the study of botany and geology, and his border-line researches benefited both sciences. His early interest in fossil plants was stimulated by W. C. Williamson, the founder of modern palæobotany in Great Britain. His first papers appeared in 1888, to be followed by more than 160 contributions to periodicals, dealing with plants of all types and ages, as well as several important books. The first of these, his Sedgwick Prize essay on "Fossil Plants as Tests of Climate", opened up an interesting palæogeographical problem to which he made other valuable contributions later. Afterwards he devoted special attention to the floras of Mesozoic times, producing a series of British Museum catalogues (1894–1904) as well as studies on Mesozoic plants from all over the world. His text-book, "Fossil Plants", in four volumes (1898–1919), will long remain a standard work of reference. It contains a mass of information assembled from widely scattered sources and is a survey of the subject of great value to future workers. "Plant Life through the Ages" (1931) was a more concise study of the field with special reference to its bearing on some of the general problems of botany and geology.

In addition to books for specialists his facile pen produced several excellent semi-popular books, the last, a work on modern geology, being completed only two days before his death. With Sir Francis Darwin he edited "More Letters of Charles Darwin", and he edited a fine volume entitled "Darwin and Modern Science" for the jubilee of the "Origin of Species". He edited an interesting volume on "Science and the Nation" (1917) and acted as general editor of the Cambridge Botanical Handbooks and of other series produced by the Cambridge University Press.

The teaching and advancement of botany at Cambridge owes much to Seward's ability as a lecturer and administrator. He was appointed University lecturer in botany in 1890 and succeeded Marshal Ward as professor in 1906. At that time the Department of Botany was rapidly expanding, and the School continued to progress and expand throughout the thirty years of his professorship. A few years before his voluntary retirement from the chair he saw a notable addition to the laboratories built, equipped and opened. He was concerned in much useful reconstruction and reorganization in the Botanic Garden, which continues to be one of the finest University gardens in the world. He saw the Cambridge Botany School become a centre of research to which post-graduate students came from all parts of the world.

During many years Seward devoted part of his energies to college work. As fellow of Emmanuel and tutor from 1899 until 1906 he guided the studies of many who have made reputations as men of science. From 1915 until 1936 he was Master of Downing, a foundation noteworthy as a place of scientific education. His mastership marks an epoch in the history of the College, which not only maintained its scientific and legal traditions but also made great progress in literary and artistic studies.

Work as a professor and master led to many other administrative responsibilities in the University, to membership of many boards and syndicates, of the council of the Senate, and eventually to the office of Vice-Chancellor at a most important period. But all this did not prevent him from taking an active part in work outside Cambridge. Always a strong supporter of the British Association and often a member of its Council, he was twice president of Section K and in 1939 of the Association. Having been elected to the Royal Society in 1898 he served for two periods on its Council and was foreign secretary and vice-president from 1934 until 1940. He was awarded the Royal and the Darwin Medals. From 1922 until 1924 he occupied the presidential chair of the Geological Society, which awarded him the Wollaston Medal. He played a great part in the organization of the Fifth International Botanical Congress, over which he presided, and he was president of the International Union of Biological Sciences in 1931. He was chairman of the Scott Polar Research Institute and also of the Fenland Research Committee. After leaving Cambridge on his retirement in 1936 he spent much time in valuable work at the British Museum, of which he became a Trustee; he also became an active member of the Advisory Council for Scientific and Industrial Research.

One other lifelong interest must be mentioned that was probably connected with the liberal principles which he so strongly held. He thought that the knowledge of science and the interest which it contributes to life should be made available to many outside the older universities. He acquired much of his power as a lecturer at the outset of his career by delivering university extension lectures, and these courses had a very stimulating influence on the study of geology in the north of England. Later he became president of the Yorkshire Naturalists' Union, and took an active interest in the establishment of the University College at Hull. He was president of the Union of South-Eastern Scientific Societies in 1935, and of the Science Masters' Association in 1929. He

worked for the establishment of a first-class journal of popular science, assisting in the management of *Discovery*, and contributing frequently to it.

Many well-merited honours came to Seward from academic bodies and scientific societies at home and abroad, and he was knighted in 1936. He had a singularly happy home life; his house was a place where many men of science have received a warm welcome and of which they have happy memories. Reminders of his genial personality remain in two excellent portraits in Cambridge, one in the hall of Downing College, the other in the Botany School.

H. HAMSHAW THOMAS.

Prof. J. S. Macdonald, F.R.S.

JOHN SMYTH MACDONALD was born in 1867. He was educated at King's School, Chester, and at Emmanuel College, Cambridge, where he took his B.A. (Math. Tripos) in 1889. In 1891 he was appointed Holt research fellow in physiology at Liverpool, and in 1897 he took the Scottish conjoint diploma in medicine. After qualification he was appointed assistant lecturer at Liverpool under Sherrington, who described the work of his Department during 1899 in the following terms: "The Department of Physical Physiology has . . . devoted most of its attention to the students, but Mr. J. S. Macdonald, the Assistant Lecturer in the subject, has also been engaged in active original research, the results of which, it is hoped, he will publish in an early number of these reports. Much work, however, has been spent in the preparation of systematic lectures, which have, indeed, been more of the nature of lecture demonstrations. The time spent has been very considerable, but now that the course with its experiments has once been arranged, it will require to be varied only in small details from year to year." The report adds that for the first time lady students had attended the classes: three ordinary students and one training for teaching. Among such men as Sherrington, B. Moore, O. Lodge and others Macdonald was fortunate in his colleagues.

The work to which Sherrington referred was published in 1902 and covered 135 large pages. It concerned "The Injury Current of Nerve". Using this as a test for the state of a nerve, Macdonald noted the changes produced in it by alteration of ions or of osmotic pressure in the surrounding fluids. By this work he took his place among the pioneers of British electrophysiology and physical chemistry applied to living tissues.

During the next few years, Macdonald published a series of articles in which he applied micro-chemistry to the investigation of nervous tissue. Using A. B. Macallum's cobalt method, he found that potassium was present not only at the point of nerve section and at the nodes of Ranvier, but also at any point where the nerve might be injured, for example, by drawing a hair tightly across it while it lay on the microscope stage. He investigated along similar lines the chloride distribution when mammalian or frog nerve was immersed either in solutions of different ions or of different ionic strengths, and he explained many previously mysterious histological findings. He showed that the axon fibrillæ were artefacts.

Macdonald began to apply the same methods to muscle, but was diverted (perhaps by its promise of scope for his mathematical powers) to the study of human energy exchanges. While professor of physiology at Sheffield he found the money with which to build there a human calorimeter room modified from the "Middletown calorimeter" described by Benedict. (This calorimeter was recently accepted by the Wellcome Medical Museum.) He set himself to study in turn the form of the curve of heat output in man during prolonged steady work on a bicycle; the relation during successive periods of work between a man's weight or his surface area and his mechanical efficiency, and finally the energy cost of different movements in work. After several papers had appeared in the *Journal of Physiology* and in the *Proceedings of the Royal Society*, Macdonald was elected a fellow of the Royal Society in 1917.

During later years Macdonald's health was unsatisfactory, and, though he retained a strong interest in the problems of muscular exercise, he gave most of his strength to the routine duties of his department. He had followed Sherrington as professor of physiology at Liverpool in 1914 and, on his retirement in 1932 at the age of sixty-five, he was appointed emeritus professor. For a time he lived near one of his sons who practised veterinary medicine in Lincolnshire, and more recently he moved to Bridge of Allan, where he died on March 29.

C. E. BRUNTON.

The Right Hon. Lord Austin, K.B.E.

BY the death of Lord Austin on May 23 at the age of seventy-four, the world has lost a great industrialist-philanthropist. As an industrialist, his name has become a household word which conjures up visions of the early small 'family' car; he was also a liberal benefactor of hospitals. Scientific workers, however, will also recall his munificent gift in 1936 to the University of Cambridge. His imagination, fired by the progress achieved by Lord Rutherford and colleagues at the Cavendish Laboratory, he gave the University approximately £250,000 for the development of the work of the Laboratory. Work on atomic physics had progressed to the stage, culminating with the demonstration by Cockcroft and Walton of the artificial disintegration of lithium, when it had become apparent that further advance involved the use of apparatus on an engineering scale. The University realized the need and also the desirability of improving facilities at the Cavendish in other ways, and had issued an appeal for a quarter of a million sterling, to which Lord Austin's gift was the splendid response.

The death of far-seeing captains of industry of the type of Lord Austin must always be a grievous loss to the world.

NEWS AND VIEWS

Royal Society of Arts: Albert Medallist

THE Council of the Royal Society of Arts has decided to confer on President Roosevelt the Albert Gold Medal of the Society in recognition of his prominent services to humanity as the fearless and resolute champion of the ideal of national freedom and individual liberty. The Albert Medal was struck in 1864 to commemorate Prince Albert's presidency of the Society during 1843–1861. It is awarded for "distinguished merit in promoting arts, manufactures, and commerce".

This award came very fittingly just in advance of President Roosevelt's declaration of a state of unlimited national emergency in the United States and of his long-awaited pronouncement on American policy in relation to the War. In effect, Mr. Roosevelt has now assumed powers which are as far-reaching as those wielded by the dictators of the totalitarian States, but with this significant difference; the dictators seized unlimited powers, whereas Mr. Roosevelt's mandate comes from the American people, who elected him president under a pledge that he would take all necessary measures to safeguard democracy in their country, and give all possible aid to the democratic nations now opposing Nazi aggression. He derives his powers from the people, who have voluntarily surrendered to him their liberties in the knowledge that the present crisis in world affairs requires swiftness and unity of action such as can be accomplished when authority is concentrated in the hands of the few; when the emergency passes with the suppression of Nazism, there are sufficient safeguards in a democratic community to ensure the effective restoration of individual liberty. The position of the United States is now similar to that in Great Britain. In his speech, Mr. Roosevelt re-affirmed the principles of democracy against the background of the story of Nazi oppression and intrigue, and asserted that freedom for the world goes with "Freedom of the seas". The United States will take all steps to provide supplies for the democracies, and will see to it that the supplies are delivered: "This can be done and must be done. It will be done."

Linnean Society of London: Gold Medallist

THE Gold Medal of the Linnean Society of London was presented to Prof. A. G. Tansley, emeritus professor of botany in the University of Oxford, at the anniversary meeting held on May 24. The Medal, which is awarded annually to "an eminent biologist as an expression of the Society's estimate of his services to science", is a fitting recognition of Prof. Tansley's contribution to ecology, and particularly to the development of the subject in Great Britain. The recent publication (1939) of his monumental work on "The British Islands and their Vegetation" rounds off an epoch in plant ecological work in Great Britain. The award of the Medal at this time thus seems particularly appropriate. Tansley's reputation as a fern anatomist was already made when, in 1904, he became one of the small group of enthusiasts, who, under the cumbrous title of the "Central Committee for the Survey and Study of British Vegetation", began systematic ecological work in Great Britain. His special contributions have been to the study of the vegetation of the English chalk. But his contribution to ecology has been far greater than his studies of particular plant communities. From the outset, Tansley was able to place his great gifts as editor and critic at the service of the committee. In 1902 he had founded a British botanical journal, the *New Phytologist*, as a private venture. For thirty years he owned and edited it. It was, and is, the avowed policy of the journal to open its pages to summaries of branches of botany "undergoing current rapid development". The British Vegetation Committee thus had a platform, controlled by one of its number, available for the discussion of concepts and principles upon which the new study should develop.

In the world of those days, international co-operation was possible. Tansley was one of those who realized the importance of personal contacts and frank discussion between the leaders of a new branch of science in different countries, if development was to proceed on right lines. He had much to do with the organization, in 1911, of the first International Phytogeographical Excursion, a memorable and ambitious tour of the British Isles, by a party of distinguished American and Continental ecologists. It was in this year, too, that Tansley edited and in large part wrote "Types of British Vegetation", a work that for many years was invaluable in interpreting British vegetation to botanists at home and abroad. When, in 1913, the British Ecological Society was founded, it was natural that Tansley should be its first president. It was not then expected that he should, in 1917, take over the secretary's work and editorship of the Society's *Journal*. This he did, and, for twenty-one years, Tansley, under his Council, guided the destiny of the *Journal of Ecology*. Its high standard, both in original papers and in critical articles and reviews, many written by him, owes much to his guidance. In 1926, Tansley was co-editor of "Aims and Methods in the Study of Vegetation", a work primarily published to foster ecological work in the Dominions and Colonies along right lines. In the preface to "The British Islands and their Vegetation" Tansley says that the work is largely "compilative". But the fact is that in this work, and throughout his long association with ecology in Great Britain, he has done much more than

publish original work, or edit and weld the work of others. He has been the friend, critic and philosophic guide of most ecologists in Britain, and many overseas. That British ecology has in the main avoided some of the criticisms and rigidities of other countries is due in no small measure to Tansley.

Institute of Metals: Medallist for 1941

Dr. C. H. Desch, scientific adviser to the Iron and Steel Research Council, has been awarded the Institute of Metals Medal for 1941, "for distinguished services to non-ferrous metallurgy". It will be recalled that Dr. Desch retired from the post of superintendent of the Metallurgical Department of the National Physical Laboratory at the end of 1939 (see Nature, January 27, 1940, p. 34), after nearly forty years of active participation in metallurgical teaching and research, both academic and industrial. His professional work, however, was not allowed to suppress his early interest in chemistry, and he is the author of well-known books on the chemistry of cement and concrete, on intermetallic compounds and on the chemistry of solids; he has also taken part in the activities of the Institute of Sociology. The Medal of the Institute of Metals which Dr. Desch has now received is given every year and was presented to the Institute by the Mond Nickel Company; it is struck in platinum. Previous recipients of the medal have been Sir William Bragg, Sir Harold Carpenter and Dr. Paul D. Merica, a distinguished American metallurgist.

"I Married Adventure"

A film with the above title is shortly to be generally released throughout the provinces of Great Britain by Columbia Pictures, Ltd. It is a full-length travel film of a similar type to the now well-known "Dark Rapture". But whereas "Dark Rapture" was concerned with the lives, habits and customs of various tribes in the Belgian Congo, "I Married Adventure" deals with expeditions to Borneo and tropical East Africa, and is outstanding not for its photographs of tribal life, but for some quite unique animal scenes. These records were collected over a period of twenty-seven years by the late Martin Johnson and his wife, Osa, the producer of this film. In Borneo they have collected some remarkable shots of anthropoids, ones of particular interest being those of the golden gibbon. There are also some excellent pictures of the small honey bear.

In Africa, Mr. and Mrs. Johnson succeeded in photographing from an aeroplane some shots of animals which were being driven in search of water by thirst. These migratory movements of hundreds of elephants, with their accompanying heron flocks, wildebeeste, giraffes and zebras are shown so clearly that they are as thrilling as they are scientifically unique. The biologist will also be gripped by some interesting photographs of onyxes, with their attendant tick-birds, and specially by a combat to the death scene of two of these onyxes. Yet another outstanding scene is that of a flock of flamingoes packed so closely together in their positions on a lake that only the birds at the edge of the group are able to get sufficient run to be able to lift themselves off the ground with their wings.

This is a film that all biologists will want to see. It must be realized, however, that it contains several jarring features which would need to be overlooked. Many of the entertainment scenes are forced, prolonged and 'unfunny'; the introduction is awkward and unattractive, while technical production falls far below the height which Hollywood has taught us to expect. After seeing the film the biologist's heart will be further saddened when he thinks of the invaluable opportunities presented to Mr. and Mrs. Johnson to secure photographs which would throw light for many of us on the peculiarities of individual tribes. Apparently these opportunities were not taken. A book of the same title (pp. 376 + 71 plates. London and Melbourne: Hutchinson and Co. (Publishers), Ltd., 1940, 10*s*. 6*d*. net) has also recently appeared. People who have seen the film will want to read the book, and *vice versa*. Unfortunately, the book is of limited value to the naturalist. Objective descriptions of natural life are few in number, and the larger part of the book is given over to describing the emotional reactions of the author during travels.

British Museum (Natural History): Recent Acquisitions

The late Dr. C. B. Ticehurst has bequeathed his important collection of birds to the Department of Zoology. The collection comprises more than seven thousand specimens, mainly from Spain, Portugal, Yugoslavia, North Africa, and north-western India. Mr. D. V. Burnett, of the Rezende Mines, Southern Rhodesia, has presented to the Department of Mineralogy a beautiful plate of crystallized gold, measuring 10 cm. × 9 cm. and $\frac{1}{2}$ mm. thick. This is the largest of a number of similar plates which have been found in cavities along a fault plane at the Old West Mine, Penhalonga Alley, Umtali. The surface of the specimen shows stepped triangular elevations with the crystal form (311), some of which are capped with a crystal stud of silver. Other donations to the Department include montgomeryite and sterretite, two new phosphate minerals from Mr. A. Montgomery, of New York, and a fine set of celestine crystals from Peak Hill, Sidmouth, presented by Miss Lillias A. Cowan.

Eskimo Material Culture

Of recent years serious attention in Great Britain has been paid to the study of the way of life of the Eskimos. Expeditions have been made and material collected. In some cases excavations have enabled investigators to obtain a chronological sequence of industries. As a result the collections in not a few of our museums—the Museum of Archæology and Ethnology at Cambridge for example—have been considerably enriched and many of the finds are still in process of being studied. Naturally American and Canadian museums have not fallen behind in this respect, and a recent article (*Ann. Carnegie Mus.*, Feb. 18, 1941) describes a collection of about a thousand specimens gathered by Eskimos from old

camp sites in the Belcher Islands in Hudson Bay and recently received by the National Museum of Canada.

Unfortunately little or no information is available about the circumstances of the finds so it is only possible to apply typological and technological methods of study. Here naturally the earlier work of Mathiassen has proved invaluable. It would seem that some of the objects must predate the historical period while others were clearly made after the introduction of iron to the district and cannot therefore belong to a period earlier than the middle of the sixteenth century and may well be a hundred years younger still. Influences from various outside areas are traced and comparisons made. The Eskimo culture has always had a special interest for prehistorians, for the conditions, and therefore the mode of life, of these arctic folk resemble to a considerable extent those obtaining in Magdalenian times. Comparisons, of course, cannot be pressed too far, but it is at least always helpful to have scientific descriptions and good illustrations of Eskimo implements.

Youth Welfare in Australia

REFERRING to the leading article entitled "Welfare of Youth" in NATURE of November 16, 1940, p. 627, Sir James Barrett, sometime chancellor of the University of Melbourne, and a well-known Australian occulist and surgeon, writes to say that in Australia the National Fitness Movement is getting well under way and relies on two organizations in the main for its efficiency, namely, the American Playground System and the municipalities, the latter item meaning decentralization. The American Playground System is now of vast proportion and aims not simply at physical efficiency but also at moral and mental development, since in competitive games rules are made and must be observed. In short, the aim is self-government.

But no playground in the United States or Australia, he writes, is of much service without trained playleaders who help to organize the activities and to enlist committees of parents who are taught what the movement means and how malnutrition can be avoided. In other words, the movement is a department in effect of the educational system. Dr. Gulick is the soul of the American movement, and those interested should read his work "The Philosophy of Play". The desire for play is innate in the animal kingdom, and is seen even in kangaroos. In human beings it is the mainspring which compels action, and it was the recognition of this fact that brought the modern playground into existence which, whilst originating in England, has been enormously developed and systematized in the North American continent.

Folk-Lore of Pulmonary Tuberculosis

IN a recent paper on this subject (*Tubercle*, **22**, 55; 1941), Dr. J. D. Rolleston states that while engaged in the composition of previous papers on the medical aspects of folk-lore (see NATURE, **143**, 111, 756; 1939) he had been struck by the numerous popular, as distinct from scientific, views concerning pulmonary tuberculosis. He had therefore collected the folk-lore of this disease, most of which was concerned with its prophylaxis and comparatively little with its ætiology and symptoms. As regards the ætiology it is noteworthy that long before it was held by the medical profession to be an infectious disease, pulmonary tuberculosis was regarded as such in some country districts in England as well as among the Karanja Indians and in Brazil. Among the causes of the disease in popular estimation were catching cold, inspiration of a very cold north wind, the sudden cure of skin diseases, especially scabies, and sexual excess.

The last factor accounted for the treatment by administration of the testes of a fox or chicken in folk medicine long before the introduction of endocrinology by Brown-Séquard. Dr. Rolleston classified the various folk-lore beliefs and methods in the prophylaxis and treatment of pulmonary tuberculosis as follows: (1) Transfer of the disease to other persons, animals and inanimate objects; (2) animal, plant and mineral remedies apart from any idea of transfer; (3) religious factors such as invocations to the Trinity, Virgin Mary and various saints, especially Pantaleon; (4) charms of different kinds, some of which dated from Anglo-Saxon times; (5) water in the form of drinking water or bathing in the sea, streams, wells and fountains; (6) one hundred and sixty-one miscellaneous remedies, such as the doctrine of signatures, the influence of the moon, odd numbers and mechanical methods.

Sources of Information on Agriculture

THE Association of Special Libraries and Information Bureaux is issuing a new series of revisions and expansions of sections of its Directory to be known as "A S L I B War-Time Guides to British Sources of Special Information". The first of this series "Fuel and Allied Interests" (excluding electricity) was issued last June. The second, entitled "Agriculture and Allied Interests", is now available A S L I B, 31 Museum Street, London, W.C.1. 5*s*. to members of A S L I B, 6*s*. to non-members). The Guide consists of forty mimeographed foolscap sheets and is divided into four sections. Section 1 summarizes the position of agriculture and describes the organization for agricultural education and research in time of war. Section 2 gives a list of sources of specialized information, indicating the nature of the work carried out and the publications issued by each body. Government and public departments, research organizations, agricultural colleges and university departments come into this category, together with professional and trade organizations and stock breeding societies. The third section provides a comprehensive list of periodicals and year books, those which print abstracts or lists of references being specified. The Guide concludes with a section consisting of subject indexes relating to both section 2 (sources of information) and section 3 (periodical publications). Compilation has been carried out in close collaboration with specialist advisers, and the details concerning the individual organizations have been supplied by the latter themselves.

Forestry in New Zealand

THE annual report of the State Forestry Service of New Zealand, drawn up by Mr. Alex. R. Entrican, director of forestry, is a concise document dealing with various forest activities. The great value of the report lies in the attention it directs to the position of the very large area of exotic plantations existing in the country and the difficulties facing their treatment. "A timber famine scare", says the author, "in all English-speaking countries was one of the products of the Great War, and it was perhaps inevitable that under the existing conditions of those times extensive tree-planting with quick-growing exotics should follow. Employment was required for large numbers of repatriated soldiers; then mass-production psychology, born out of munitions and automobile manufacture, favoured large-scale forestry operations. To some degree extensive areas had been planted with unsuitable species or consist of soil fit for neither agriculture nor forestry. The former has often been due to the impossibility of obtaining the amounts of suitable seed required in the general large scramble to plant."

The most serious result, however, is connected with neither of the above. This urgent large-scale planting has been the creation of 750,000 acres of plantations with complete disregard for the essential necessity of creating well-distributed age classes. For example, three State exotic forests totalling 41,000 acres were 91 per cent planted during the five-year period 1927–31. During the same period more than 80 per cent of the total State *insignis* pine stands were planted, and more than 50 per cent of the privately owned stands. It will be obvious to any forester that the correct management of this enormous area of almost even-aged forests is going to prove a difficult problem. As the director of forestry correctly says, only by intensive planning and organization may enormous losses be avoided in these medium-age classes which form such a large proportion of the exotic forest resource. A future better distribution of age classes is obviously an aim. To assist, a recommendation is made that for the present all fellings in indigenous forests should cease.

"Kill Statistics" from California

GAME birds and animals form a valuable food resource of any country, but the permanent value of the resource depends upon the skill with which it is at once utilized and husbanded. In California the control of game is supervised by the Division of Fish and Game, and in order that effective regulations may be made it is essential that the Division should know how many individuals of each species are killed in the various parts of the State. In one area a species may be abundant in spite of the sportsman, in another it may require further protection. The method of collecting the information upon which legislation depends is by questionnaire, attached to hunting licence application forms, and the experts are convinced that the returns give a reasonably accurate tale of the slaughter. The statistics for 1938 have been published by J. I. Hunter and Donald H. Fry, jun. and reveal some astonishing numbers (*California Fish and Game*, **26**, 310; 1940). The estimated number of ducks killed was 950,000; geese, 90,000; pigeons (Columba), 95,000; doves (mainly Zenaidura), 1,700,000; quail, 1,500,000; pheasants, 125,000. The mammal numbers are also very considerable: cottontail and brush rabbits, 500,000; jack rabbits, 750,000; deer (two species), 35,045. In 1939, 43,251 deer were killed, a number strongly in contrast with the moderate slaughter of twenty-five years ago, when the estimate of killed reached only 12,000.

Caffelite: a New Plastic

FOR many years excess production of coffee has been a serious problem for the Brazilian Government; thousands of bags have been deliberately destroyed every year to prevent them coming on the market. Now that markets in Germany, Italy and other European countries are lost to them, the position is even more serious. According to the *Electrician* of April 18, an investigation conducted in New York has led to the discovery of a new plastic material, which is known as 'Caffelite', and industrial plants will come into operation in Brazil this year in which at least part of the excess supply of coffee will be absorbed in the manufacture of Caffelite. The product is said to have useful electric properties at low frequencies. The material is moulded under pressure of one or two tons per square inch, and has a specific gravity of 1·43, that is, about ten per cent higher than wood flour filled phenolic moulding materials of the 'Bakelite' type. The other physical properties are stated to be similar to those of 'Bakelite', and it is claimed that all colours can be produced except white.

Engineering Construction in India

IN *Engineering* of April 4 there is an article on a welded water main in Burma which gives an interesting illustration of the growing self-sufficiency of India and Burma from the point of view of engineering construction. Forty-three miles of water main 4 ft. 10 in. in diameter were required for the city of Rangoon. The steel plate was rolled by the Tata Iron and Steel Co. Ltd. at Jamshedpur, and shipped to Rangoon, where the fabrication was effected by Messrs. Braithwaite, Burn and Jessop Construction, Ltd. The main was made in lengths of 25 ft., each length of pipe consisting of three plates in the circumference, the plates as rolled being 62 in. wide by $\frac{7}{16}$ in. thick. After the plates had been bent to one-third of a circle, each set of three was assembled in six rigid rings spaced equally along the length of the pipe and supported on rollers. An automatic carbon-arc welding head, of the 'electronic tornado' type, mounted on a small carriage, was then run along the longitudinal seam at the bottom of the assembly and the pipe rotated for the welding of the two remaining seams in the same position. The inside seams were butt-welded. They were not completely welded from the inside only, a second run on the outside surface of the pipe with an automatic carbon-arc welding-

head being required to complete them. The fabrication of this water main necessitated the employment of 500 men, all but ten of whom were native workers. It is noticeable that the time taken for completing the contract was six months shorter than the scheduled time, this being due to the adoption of welding for the construction.

Earthquakes in Spain

Two earthquake shocks caused some slight damage at Jativa, in Valencia, Spain, on May 23. No casualties are reported. Slight earthquake shocks are fairly frequent in southern Spain, which is part of the seismic zone stretching from the Atlantic Ocean at least to Turkey through the Mediterranean.

The Night Sky in June

On or about June 21, the date of the summer solstice, the nights in the latitude of London last barely 7½ hours, if reckoned from sunset to sunrise; but nautical twilight (sun not more than 12° below the horizon) reduces the duration of actual darkness to about 3 hours. Nautical twilight lasts all night throughout the month in Lat. 56° N. Conditions for scanning the night skies this month are therefore much restricted. The moon is full on June 9 at 12·6h. and new on June 24 at 19·4h. Mercury may be seen in the evening twilight this month, greatest elongation of 24° east being reached on June 6. Venus is also an evening star and is in conjunction with Mercury on June 20. Telescopic views will show Mercury as a diminishing crescent and Venus as nearly full in phase. Mars rises in the early morning and is 5° above the eastern horizon soon after 1h. 30m. at the beginning of June and before 0h. 30m. at the end of the month. (All times are given in Universal Time; add 2 hours to convert to Midsummer Time.) The brightness of the planet is increasing; conjunction with the moon occurs on June 16. Saturn is a morning star, low in the east before sunrise; and after mid-June Jupiter comes likewise into view. Saturn is in conjunction with the waning moon on June 21 and Jupiter on the following day.

Portrait of H. E. Armstrong

The first Armstrong Memorial Lecture was delivered by Dr. E. F. Armstrong on February 3. The complete Lecture was published in *Chemistry and Industry* of February 8, and included a striking photograph of "H. E. A." in holiday mood, taken by Mr. Edwin Thompson on board ship between Vancouver and Victoria after the Winnipeg meeting in 1909 of the British Association. Mr. Thompson has a number of photogravure reproductions of this portrait which he is willing to give free of charge to anyone interested; requests should be made to him at Speke Hall Road, Liverpool, 19.

Announcements

At the anniversary meeting of the Linnean Society, held on May 24, the following were elected officers for the year 1941–42: *President*, Dr. E. S. Russell; *Treasurer*, Major F. C. Stern; *Secretaries*, Mr. I. H. Burkill (botany), and Dr. Malcolm Smith (zoology); *New Members of Council*, Dr. B. Barnes, Prof. F. T. Brooks, Mr. J. E. Dandy, Mr. A. C. Gardiner and Mr. Douglas M. Reid.

The Carnegie Corporation of the United States has granted the Society £2,000 for the purpose of photographing the manuscripts and natural history specimens in the collections of Linnæus.

At the annual general meeting of the Royal Sanitary Institute the Earl of Bessborough was elected president in succession to Lord Balfour of Burleigh, whose period of office had expired.

The late Dr. Charles Slater has left £4,000 to the University of Cambridge for teaching or research work in medical science or any science ancillary to medicine at the discretion of the University.

Dr. W. G. Woolnough, geological adviser to the Federal Government of Australia, has retired from the Commonwealth Public Service after thirteen years service and has been succeeded by Dr. R. W. Raggatt, of the Commonwealth Geological Staff.

There will be an exhibition of maps, plans and panoramas of London from the sixteenth century until to-day at the Royal Institute of British Architects, 66 Portland Place, W.1, during the period May 29—June 21, between the hours of 10 a.m. and 6 p.m. (Saturdays, 10 a.m. and 1 p.m.); admission free. The opening of the exhibition will coincide with a lecture on the planning of London, which Mr. W. H. Ansell, president of the Institute, is giving at the Royal Institution on May 29. The exhibits have been drawn mainly from the Institute's own collection; as a precautionary measure, the earlier maps and panoramas will mostly be represented by facsimile copies made by the London Topographical Society.

War has again inflicted severe losses on the University of Louvain. Numerous University buildings were destroyed during hostilities, including the library rebuilt by American generosity and restocked by gifts from nearly every university in the world. Of its 900,000 volumes 15,000 only remain intact, and of its 800 manuscripts only 15 are left.

The Glass Manufacturers' Federation has recently established, for the duration of the War, a Defence Advisory Panel, to advise on scientific, technical and allied problems relating to glass which may arise as the result of contacts between Service or other Government Departments and the Federation. Its members are: Prof. W. E. S. Turner (chairman), Dr. B. P. Dudding, Dr. W. M. Hampton, Dr. H. Moore, Mr. J. B. Murgatroyd, Dr. C. J. Peddle and Dr. E. Seddon. Communications for the Advisory Panel should be addressed to Mr. Geoffrey Marchand, director of the Glass Manufacturers' Federation, Orleans, Latimer Road, New Barnet, Herts.

LETTERS TO THE EDITORS

The Editors do not hold themselves responsible for opinions expressed by their correspondents. They cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.*

IN THE PRESENT CIRCUMSTANCES, PROOFS OF "LETTERS" WILL NOT BE SUBMITTED TO CORRESPONDENTS OUTSIDE GREAT BRITAIN.

Diffuse Reflexion of X-Rays

I WISH to add some remarks concerning the theory of the new effect described by G. D. Preston in his article published under the above title in NATURE of April 19, p. 467. A critical study of the suggestions brought forward by Sir C. V. Raman and Sir William Bragg showed that they cannot be accepted as possible explanations, and some photographs kindly sent to me by Mrs. Lonsdale convinced me that the effect ought to be a consequence of Debye's well-known theory of the influence of thermal vibrations on the scattering of X-rays. As the literature on this subject, although extended, is not satisfactory, I have (in collaboration with Miss K. Sarginson) reconsidered the problem assuming that the scattering power of each single atom is known, and only the influence of the atomic vibrations is to be determined.

Apart from the effect on the intensity of the Laue spots (treated by Debye, Waller and others), there exists a background scattering given by an expression which is not an average over the vibrations (as specific heat is) but depends explicitly on their amplitudes and frequencies. The expressions are rather complicated. In order to simplify them we have assumed that the vectorial waves of atomic vibrations can be approximately replaced by scalar waves. Even then the formula is too complicated to be written down here. It gives a definite intensity distribution of the scattered light for any direction of the incident beam relative to the crystal. It depends, apart from the universal constants, h, k, c, on the wave-length λ of the X-rays and some properties of the atoms and the lattice: the lattice constant, the atomic weight and the function $\omega(\mathfrak{q})$ representing the elastic frequencies as a function of the wave vector $\mathfrak{q}$. In fact, the intensity is in this approximation a monotonically decreasing function of this $\omega(\mathfrak{q})$; therefore the maxima of intensity coincide with the minima of $\omega(\mathfrak{q})$.

This result explains most of the features which have been discussed in connexion with the extra spots. The first point is the fact that each extra spot is associated with a Laue spot which it passes when the crystal is rotated, with rapidly changing intensity (increasing for approach to the Laue spot). Indeed, the Laue spots are given by the absolute minima $\omega(2\pi) = 0$ ($\mathfrak{h} = (h_1\ h_2\ h_3)$ three integers), which occur only for definite relative positions of crystal and incident ray. If the crystal is rotated the wave vector $\mathfrak{q}$, as argument of $\omega(\mathfrak{q})$, has to satisfy the relation

$$\mathfrak{q} = \mathbf{K}' - \mathbf{K},$$

where $\mathbf{K}, \mathbf{K}'$ are the wave vectors of the incident and scattered beam. If $\mathbf{K}$ is given, $\omega(\mathfrak{q})$ is a function of $\mathbf{K}'$ which has relative minima: these are the centres of the extra spots. This result, that the position of the spots is closely connected with the vibrational spectrum of the crystal, is very remarkable. It leads immediately to an understanding of the success of Sir William Bragg's formula. I cannot accept Preston's and Bragg's suggestion that there exist little groups of atoms (such as Bragg's cubes) which scatter independently of the rest of the crystal. This explanation is based on the assumption that the interference effects are due to the *geometry* of the lattice. In fact, these new interferences, which depend on temperature, are due to the *dynamics* of the lattice. One has merely to assume that the forces between the atoms are negligible except for first neighbours; then $\omega(\mathfrak{q})$ becomes a periodic function in the reciprocal lattice of the very type from which Bragg derives his formula. We obtain precisely Bragg's formula for a body-centred cubic lattice, and very similar ones for other cubic lattices. But we get in addition a reasonable law for the intensity as a function of temperature which cannot be obtained by any purely geometrical explanation.

We have also studied in detail the behaviour of the extra spots in the neighbourhood of a Laue spot h, with the help of a development in powers of $\varphi - \varphi_h$, the angular displacement of the crystal from the position corresponding to a Laue spot. If the direction of the incident beam is taken as x-axis, and the crystal is rotated about the y-axis, we obtain for the direction cosines ξ, η, ζ ($\xi^2 + \eta^2 + \zeta^2 = 1$) of the scattered beam

$$\begin{cases} \eta - \eta_h = \eta_h \xi_h (\varphi - \varphi_h) \\ \xi - \xi_h = (\zeta_h^2 + \xi_h - 1)(\varphi - \varphi_h), \end{cases}$$

where ξ_h, η_h, ζ_h is the direction vector of the Laue spot. These formulæ are purely geometrical and give no information about the physical mechanism. The same holds for the formula giving the angle χ between the extra ray and the Laue ray, for which one obtains

$$\chi = 2 \sin^2 \frac{\theta_h}{2} (\varphi - \varphi_h)$$

where θ_h is the deflexion angle of the Laue spot, which has been derived by several authors (Faxén, Raman, Jauncey, Preston, Lonsdale) on different assumptions.

The physical assumptions of the theory can be tested only by a discussion of the expression obtained for the intensity distribution. We have determined the shape of the spot, that is, the lines of equal intensity; they are ellipses the minor axes of which coincide with the meridian passing through the Laue spot. We have further calculated the maximum and the total intensity of the extra spot; these depend on the neighbouring Laue spot, on the temperature, the wave-length of the X-rays, and the constants of the crystal, chiefly the maximum frequency ω_m of the elastic spectrum, or the corresponding temperature $\theta = h\omega_m/k$. All results are in qualitative agreement with the observations.

MAX BORN.

Department of Natural Philosophy,
The University,
Edinburgh.
May 3.

Free Aryl Radicals in the Fittig and Ullmann Reactions

Hey and Waters[1] have given a valuable review of some organic reactions involving the formation of free radicals in solution. From this and from later work two properties stand out among others as being characteristic of free aryl radicals in solution. One of these is the persistence with which such radicals remove hydrogen from all solvents containing non-aromatic hydrogen, and so become converted to the corresponding aryl hydrogen compounds; and the other is the displacement by them of hydrogen from aromatic liquids to yield biaryls, the substitution occurring invariably *ortho* and *para* to substituents in the benzene ring, irrespective of their nature.

In a series of Ullmann, Fittig and related reactions carried out recently in this laboratory, it was consistently observed that one of the products formed on treating ArX (X = Cl, Br, or I) with sodium or copper was the corresponding aryl hydrogen compound ArH. It seemed probable that this was a result of the formation of free aryl radicals in the reaction, and that ArH was formed from these either by reaction with the diluent (ether), where this was present, or by dismutation when diluent was absent[2].

In order to obtain confirmation of this view, iodobenzene was caused to react with copper bronze in a sealed tube in the presence of an excess of ethyl benzoate, when it was expected that free phenyl radicals if formed would displace hydrogen from the *ortho* and *para* positions in the ethyl benzoate. The product of the reaction was boiled with caustic alkali, and neutral material was separated by ether extraction. On acidification of the alkaline solution a mixture of acids was obtained, in which diphenyl-2-carboxylic acid and diphenyl-4-carboxylic acid have been shown to be present. The latter was easily separated in a pure condition by fractional recrystallization, and the former, which was more difficult to purify, was shown to be present since fluorenone could be isolated from the reaction mixture after treatment with sulphuric acid. No evidence was obtained for the presence of any other components in the mixture.

The isolation of these substances is strong evidence for the formation of free radicals as intermediates in this reaction, and it and allied reactions are under investigation from a similar point of view. The results will be recorded elsewhere.

W. S. RAPSON.
R. G. SHUTTLEWORTH.

Department of Chemistry,
University of Cape Town.
Feb. 1.

[1] Hey and Waters, *Chem. Rev.*, **21**, 169 (1937).
[2] Cf. Hammett, "Physical Organic Chemistry", McGraw-Hill (1940), p. 144.

Respiration of Leguminous Root Nodules.

A PREVIOUS communication from one of us (G. B.[1]) referred to observations on the rate of evolution of respiratory carbon dioxide from leguminous root nodules still attached to the plant. Those observations have been extended and are being published elsewhere. A brief report is presented here of other observations (which will not be continued at present) on detached nodules, made by means of a respirometer designed by one of us (G. F. A.). This apparatus provides concurrent records of oxygen intake and carbon dioxide evolution and is being described in another publication. It is our belief that the only complete figures for the respiratory gaseous exchange of nodules so far published are those of Allison and his collaborators[2,3], though recently Wilson[4] has recorded observations on oxygen intake. Information concerning respiratory events within the nodule will contribute to an increased understanding of the general metabolism of the nodule, including the process of nitrogen fixation.

The observations were made at a temperature of 25° C. on nodules taken mostly from Manchu soya bean plants growing in solution culture. During the determinations the nodules usually were kept moistened with the inorganic nutrient solution in which the plants had been grown. All figures quoted refer to c. mm. oxygen absorbed or carbon dioxide evolved per hour per mgm. dry weight of tissue. In twelve experiments with nodules of various sizes from soya bean plants inoculated with Wisconsin strain No. 505 of the nodule organism, values ranging from 2·31 to 6·25 were obtained for oxygen intake. Using nodules from field-grown soya bean plants, Allison *et al.*[2], at 28° C., obtained lower values for oxygen intake in air (range 0·76–2·05), while Wilson[4] reports a value of 1·53 for nodules from plants infected with strain 505. Allison *et al.* observed that the respiratory quotient was well above unity for nodules respiring in air, the range for soya bean nodules being 1·23–2·00. Partly because of this type of result they concluded that partially anærobic conditions prevail within nodule tissues. In our material also the respiratory quotient was usually greater than unity (range 1–1·25). For detached younger parts of the roots of the same soya bean plants, values of 1·70–2·17 were obtained for oxygen absorption, with quotients very close to unity. The rate of respiration of the roots was thus inferior to that of the nodules, whereas Allison *et al.*[3] concluded that in their material root and nodule respiration were of the same order. Wilson[4], on the other hand, observed root respiration to be considerably in excess of nodule respiration. It thus appears that the intensity of respiration within leguminous nodules and roots is liable to vary in material from different sources.

Contrary to the experience of Allison *et al.*[3], in our material of soya bean nodules no definite tendency was detected for the respiratory quotient to be higher in larger nodules than in smaller ones, though observations on this point were not extensive. Nodules from plants infected with an ineffective strain of the nodule organism (No. 507) showed much lower rates of respiration (oxygen absorption 0·7), though the respiratory quotient was similar to that characterizing nodules in which normal fixation was proceeding. For pea (*Pisum sativum*) nodules figures of 1·89–3·24 were obtained for oxygen intake, the respiratory quotients ranging from 1·05 to 1·25. In all these observations the respiration measured is, of course, due partly to the plant tissues of the nodule as well as to the bacteria.

G. F. ASPREY.
G. BOND.

Botany Department,
University of Glasgow.
April 29.

[1] Bond, NATURE, **144**, 906 (1939).
[2] Allison, Ludwig, Hoover and Minor, *Bot. Gaz.*, **101**, 513 (1940).
[3] Allison, Ludwig, Minor and Hoover, *Bot. Gaz.*, **101**, 534 (1940).
[4] Wilson, "Biochemistry of Symbiotic Nitrogen Fixation" (1940).

Publication of New Species

ONE of the inevitable results of the War is a reduction in the output of pure scientific literature. This enforced breathing-space seems an excellent opportunity for scientific workers in general, but systematic zoologists in particular, to assail the problem of the scattering of the literature.

In year 1935	Number of publications other than books	Number of journals used	Number of authors	Authors publishing single paper during the year	Authors who publish more than one paper and confine publication to one journal only	Journals publishing one paper only devoted to the one group of animals in question	Journals entirely devoted to one group in question	Number of new species described in the year	Number of journals in which these new species are described	New species described in purely medical journals
Protozoa*	940	263	605	441	48	150	3	549	83	9
Mollusca	1117	376	698	528	56	184	7	1437	139	Not checked; probably none
Helminths (including medical literature)	1400 (392 medical)	451 (166 medical)	1191	1037	55	287	3	776	112	34
Siphonaptera (Insecta)	19	17	15	14	1	15	0	15	5	1
Aves	1662	388	1043	769	93	203	39	230†	39	Not checked; probably none

* These groups are not comparable as entities, and include fossil species.

† Sub-species as well as species.

Probably only systematists are aware of the extent of this scattering. The output is considerable (Salt points out that 10,000 new species of insects are described every year), but nevertheless a disproportionate amount of time is spent 'grubbing' in the library. Who has not groaned over obscure periodicals, such as the *Acta Univ. Latv.*, the *Est. de Sci. Habana* or the perennial *Igakkai Zasshi*?

The table above shows an analysis of the literature of a twelve-months' period chosen at random, and relating to five groups of animals, also chosen at random. No comment is really necessary, but one or two points may be emphasized:

(*a*) The number of journals which, during the year, print only *a single* paper dealing with any one of the groups in question;

(*b*) The low percentage (20 per cent) of authors publishing more than one paper during the year, who confine these to one journal;

(*c*) The scattering of descriptions of 776 new species of helminths through 112 journals.

The causes of this literary diaspora are diverse and numerous. Authors, for example, may desire to publish several papers simultaneously, or obtain plates to illustrate them all, or to increase the circle of their readers, or to achieve priority by rapid publication in some modest journal without a waiting list. Financial considerations, on the other hand, prohibit the production of many journals devoted to single groups, except in cases of special popularity, such as we find in the class Aves. Institutes which publish their own journals must include widely divergent contributions. Editors, with an eye to the standard of their publication, its circulation and limited resources, look upon short papers with favour and encourage 'variety'. There are also geographical, nationalistic and linguistic groupings. Nevertheless, however diverse the legitimate and non-legitimate reasons for the scattering may be, the fundamental underlying cause is the total lack of any real system associated with the publication of scientific literature.

Perhaps it is over-sanguine to dream of international co-operation at the present moment, but even co-operation on a small scale between editors in any one country might lay the foundation for more ambitious and far-reaching schemes.

A little judicious exchange would eliminate those cases of journals printing, for example, one helminthological paper a year, and render impossible specific zoological descriptions of new species appearing exclusively, for example, in *Arch. Experimental Medicine*. For institutions, a more widespread application of the system of publication of the American Museum might also be advocated.

We hear much from politicians on the subject of post-war reconstruction. Surely the systematic zoologists will seize this unequalled opportunity for turning the present loss of time into future gain?

MIRIAM ROTHSCHILD.

Ashton Wold,
Peterborough.

Decipherment of Charred Documents

THE large number of hand-written documents, such as deeds, accounts and ledgers, which have recently been damaged or destroyed by fire has inevitably directed attention to methods of deciphering charred documents, and the description of a simple photographic method recently found successful in these laboratories may be of interest. The documents on which most of our experiments have been carried out were burnt completely black, but were fairly resistant to handling and showed traces of the writing in relief on the surface. No results were obtained by ordinary photographic copying methods with oblique lighting, with infra-red or ultra-violet radiations, or by the chloral hydrate method described by Messrs. Taylor and Walls of the Metropolitan Police Laboratory at Hendon[1].

The method depends on exaggerating photographically the difference between the specular reflectivity of the remains of the plain paper and of the ink. Essentially, the charred paper surface can be regarded as a mirror the surface of which can be made to reflect an intense source of light close to the camera lens and on which the original writing stands out as a dark shadow, presumably due to the disturbance of the paper fibres by the pen and to the presence of some residual salts from the ink. This shadow is photographed by the use of a high contrast blue-sensitive plate such as the Kodak *B* 5.

In practice, it is first necessary to render the charred sheet absolutely flat. With the more robust of the specimens, this is easily possible in a pressure printing frame. If the pressure is applied evenly and fairly slowly the sheet does not tend to crack up. It has been found satisfactory to press more fragile specimens gently on to the damp surface of a gelatin-coated glass sheet, such as a fixed-out and washed photographic plate, and then to apply pressure in the frame.

The most suitable lighting has been found to be a small arc lamp close to the camera with a lens so arranged that it throws a narrow beam of light on to the copy. This gives the required illumination and, in conjunction with a long-focus lens on the camera, the optimum type of reflexion into the lens from the surface of the document. It is well known that differentiation between specularly and diffusely reflected light can be increased by the use of polarizing screens over the camera lens, but so far this additional step has not been found necessary for successful deciphering of the documents we have examined.

No claims are made for the infallibility of the method described, and, in fact, it is probably practical only with a fairly limited number of combinations of ink and paper, but, as it has been found to work excellently in some cases where all the methods described in the literature have failed, we feel that its publication may be of use to other workers.

G. A. JONES.

Research Laboratories,
Kodak, Ltd., Harrow, Middlesex.

[1] NATURE, **147**, 417 (1941).

"The Man of Science as Aristocrat"

LIEUT.-COLONEL MOORE-BRABAZON has fallen into a common error of thought when he says that a politician who ensures a milk supply deserves more of his fellow men than does the inventor of the quantum theory[1]. The boy who posts a lighted squib in a pillar box commits the same offence whether the pillar box is empty or is filled with an unusually important mail. The fact that an action does not seem to the majority to be of immediate consequence is no guide to its importance. Colonel Moore-Brabazon's hypothetical politician will be deserving of the severest censure if he does not ensure the necessary milk supply, provided always that he is aware that our state of mechanical and scientific development is such as to make it possible; he deserves no credit for doing what is simply his job.

Our difficulties lie in the provision of such gifted public servants. Many of those we now have, by their lack of a scientific background, are unaware that the solutions of their problems exist, and in some instances there is even a suspicion that the existence of the problem itself goes unnoticed. The imperative need for men of science with a responsibility in public affairs, in a social system which has changed out of recognition in a period measured in months, is not at all appreciated.

It is true that, "in the narrow world of science" the inventor of the quantum theory gets more attention than the average run of politicians do; but it must also be pointed out that the man of science who enters the public service is left in no doubt of the inferiority of his position compared with that of his lay colleagues. In consequence of this, cases are known of young men with the foundation stone of scientific knowledge laid at their universities who have seen the financial folly of building a superstructure of experience thereon, and have deliberately concealed their degrees in science in order to taste the fleshpots of an 'administrative' post which could be filled by an intelligent clerk. Such a man is a waste of material, since it is only by the practice of science over a period of years that he gains a knowledge which is likely to be useful to his fellow men. By that time an attempt to 'come out of his shell' is usually out of the question on account of his age and lack of 'administrative' experience, for he will naturally prefer to remain in his shell rather than enter a new field as a junior.

R. A. JONES.

4 Enslin Road,
London, S.E.9.

[1] NATURE, **147**, 544 (1941).

Reservation of Librarians

I SHOULD like to direct attention to a serious defect in the Schedule of Reserved Occupations just issued by the Ministry of Labour. While the librarians of newspapers, periodicals or news agencies are reserved at the age of thirty-five, the librarian of a university, public or research institution library is not reserved at all. General clerical staffs of universities and municipalities are also reserved at thirty-five, and it would therefore appear that the importance of what to every scientific worker is a vital tool—a well-selected and organized library under competent direction—is not realized by the Ministry.

NATURE has from time to time given space to notes about the pioneer work of the Science and Technology Department of the Sheffield City Libraries, particularly in regard to the organization of the interchange of technical information between research libraries in the Sheffield area. This Library may be used as an illustration of the unwisdom of the Ministry's decision. Since the War began, the Science and Technology Library has issued more than forty bibliographies dealing with specialized aspects of steel making and steel treatment. Requests for copies of these bibliographies have been received from scores of important industrial establishments, both at home and overseas, which maintain research staffs, and copies of some of them are being prepared for distribution by the Ministry of Supply. It would seem reasonable to suggest that the librarian of a library of this type, which can be paralleled by similar special public libraries in other great cities, should be held to contribute as much to the promotion of the War as a routine clerk in other departments of the municipal service.

J. HAWNT,
Chairman of the Libraries, Art Galleries and Museums Committee, Sheffield.

We believe that the principal purpose of the Schedule was to obtain postponement of the calling-up of whole groups of people. In addition, an employer may apply for the deferment of the calling-up of an individual who is personally indispensable, and each such case is considered on its individual merits. In view of the high proportion of librarians for whom reservation will no doubt be justly claimed, it would seem that qualification of the Schedule definition is desirable.—Editors of "NATURE."

RESEARCH ITEMS

Breeding-Place of Ross's Goose

Ross's goose, *Chen rossi*, has many associations with the Hudson's Bay Company. One of its officers recorded it in 1795, in 1861 it was named after the officer at Fort Resolution, and now in 1940 the support of the Company and the energy of its representatives have solved the mystery of its breeding-place (P. A. Taverner, *Canadian Field-Naturalist*, **54**, 127). This small goose, scarcely larger than a mallard duck, used to be abundant about Lake Athabasca and Great Slave Lake, where so many were killed and salted for winter food that fears have been expressed for its survival. But until now nothing has been known about its breeding haunts, and the only egg in existence was one laid in captivity. In 1940 the Hudson's Bay Company authorized an expedition for the express purpose of solving the problem, and guided by promising native reports the explorers, two managers of the Company's posts and four Eskimos with a canoe on dog-sled, pushed up the Perry River which flows into Queen Maud Gulf close to longitude 102° West. Up a tributary of the Perry they reached an unnamed lake—the country is unexplored and unmapped—where large numbers of Ross's geese were seen. The lake was studded with two or three hundred islets, and on these the white geese were nesting, looking at a distance like ptarmigan in winter plumage. The nests, sometimes within three feet of each other, were about a foot across, lined with down, and contained from two to six creamy-white eggs. Natives reported that the chief breeding-grounds were on an island in a larger lake about six miles away, and they reckoned that about two thousand would be nesting there.

Termite Investigations in Australia

Two species of mound-building termites, namely, *Eutermes exitiosus* Hill and *Coptotermes lacteus* (Froggi) have been the subjects of several investigations carried out under the ægis of the Council for Scientific and Industrial Research for Australia. Two papers, by F. J. Gay and J. Greaves, which deal more especially with the last-named species, have recently been published (*J. Coun. Sci. Ind. Res.*, **13**, No. 2; 1940). The first paper is concerned with analyses of the populations of two colonies of *C. lacteus*, and is complementary to an earlier paper dealing with the population of Eutermes colonies. Coptotermes, it may be added, is the genus responsible for most of the damage incurred by termites in Australia. The estimated populations of two colonies of the species *C. lacteus* amounted to 600,000 and 1,100,000 individuals respectively, with a caste ratio of 86–92 per cent of workers, 6–7·5 per cent of reproductive nymphs and 2–3 per cent of soldiers. Compared with *E. exitiosus* the proportion of soldiers is much lower in *C. lacteus*, whose whole population is also rather less. In a second paper in the same issue of the journal already named, the authors discuss the subterranean foraging galleries which radiate from the central mound or nest of *C. lacteus*. Some fifteen main galleries were found to branch in a manner that causes them to extend over an area of approximately 1½ acres. These galleries enable the termites to reach logs or pieces of dead wood, which provides their staple food. Such logs may be up to 50 yards distant from the central mound. In each of two other mounds, located in a different type of habitat, the foraging galleries were more than thirty to a nest. While these galleries may lead with reasonable directness to neighbouring logs, their detailed meanderings en route indicate that such passages rarely point in the actual direction of the logs with which they become ultimately connected. It is concluded that the termites in question do not possess any mysterious sense of direction which some observers may be inclined to attribute to them.

British Water Bugs

We have recently received Scientific Publication, No. 4, of the Freshwater Biological Association of the British Empire. The work in question is entitled "A Key to the British Water Bugs", 1941, and is written by T. T. Macan. In the small compass of thirty-six pages is included sufficient information and illustrations to enable all British aquatic Hemiptera-Heteroptera, excluding the Corixidæ, to be readily identified. Notes on the biology and distribution of the various species are included, together with a list of the more important original papers bearing upon the subject. For the Corixidæ the reader is referred to a previous publication issued by the Association. It is noteworthy that the last comprehensive work on British Heteroptera, which included the aquatic forms, was that by Butler, published in 1923. Since that time recent work has made this volume somewhat out of date in so far as the grouping of the members of Notonecta are concerned, while the addition of a species of Hydrometra and of two species of Microvelia to the British fauna have to be noted. These and other features are dealt with in Dr. Macan's brochure, which is obtainable from the Association at Wray Castle, Ambleside, Westmorland, price 1*s.* 6*d.*

Microsporophylls of Caytonia

A reinvestigation by Prof. T. M. Harris (*Ann. Bot.*, N.S., **5**, No. 17; Jan. 1941) of the microsporophylls of Caytonia greatly strengthens the evidence for associating the Caytoniales with the Pteridosperms rather than with the Angiosperms. In construction and mode of dehiscence the Caytonanthus synangium is wholly unlike any flowering plant anther, while the leaf-like branching and dorsiventral structure of the whole sporophyll is equally remote in morphology from any Angiosperm stamen. The synangia of some fossil Marattiaceæ and Pteridosperms, however, show much closer resemblances to Caytonanthus which also shares with some Mesozoic plants of Pteridospermous affinity the winged pollen grains which mark it off from all known Angiosperms. A critical re-examination of the pollen grains leads to the recognition of another species of Caytonanthus, *C. oncodes*, which differs from *C. Arberi* in the dimensions of the pollen grains. The former is referred to *Caytonia Sewardi* which it pollinates while the pollen in the micropyles of seeds of *Caytonia Nathorsti* is referred to *C. Arberi*.

Banana Leaf Disease

RECOGNITION of the fact that the leaf spot disease of bananas (*Cercospora musæ* Zimm.) in Jamaica is likely to remain, has directed attention to the need for securing control at minimum cost. Spraying with copper-containing fungicides has been found to give good control, but under Jamaica conditions is liable to prove expensive, tedious and, on much of the land under cultivation, difficult. It is therefore necessary that simple and economic means of securing adequate control should be sought. Recent investigations by R. Leach (Bull. 26, Dept. Sci. and Agr., Jamaica, 1941) have been undertaken with this end in view. As elsewhere the heart leaves are most subject to infection. A curious feature noted by Leach, as also by other investigators, is that while spraying gives good control, the waxy heart leaves are, nevertheless, seldom adequately covered with spray. The view is put forward that spraying attains control for the most part by interfering with the production of Cercospora spores and by affecting the germination of spores which may reach the unsprayed heart leaf —a conclusion which may not receive general complete acceptance. Shade has again been found to be an important factor in reducing spore production in that it also reduces dew formation. An indication has also been obtained that appreciable damage from secondary infection on older leaves occurs only spasmodically, under conditions as yet undetermined although apparently connected with a marked fluctuation in soil moisture conditions. The general conclusion is reached that the nature of leaf spot disease is essentially cumulative.

Inheritance of Pits in the Ears

PITS in the ears which sometimes simulate holes pierced for ear-rings are shown to be inherited in man by H. W. Edwards and C. E. Keeler (*J. Hered.*, **31**, 507–510; 1941). These pits on both lateral and medial surface of the lobe of the ear do not usually form a channel through the ear, but appear similar to old, healed, ear-ring puncture marks. The character is inherited in two families as an irregular dominant, with indications of other factors which modify the expression.

Topography of the Red Sea

A REPORT issued by the Egyptian Biological Station at Ghardaqa contains an account of its preliminary exploration of the Red Sea, arranged under C. Crossland in H.E.M.S. *Mabahith*, which was fitted with sonic sounding. The cruises included six traverses across the northern part of the Red Sea, a special investigation of the entrance to the Gulf of Aqaba and two sections along its length and five across. The Gulf of Suez is a shallow shelf at 30–40 fm., while Aqaba is separated by a sill at 140 fm. Within there is a depth of more than 1,000 fm.; this occurs on its east side where the slope is practically a precipice, ending in the cliffs of mountains equally high above sea-level. For charting, adjustments of the echo soundings have to be made, for the echo comes from the nearest land face, so that in front of a precipice it will be at a considerable angle to the vertical. In the Red Sea the long trough more than 1,000 fm. deep proved to be a narrow valley, a regular rift feature. The descent to this is by a series of steps, some of which on the Arabian side are reached by precipitous falls of 400–500 fm. Indeed the features described by Wharton for Masamarhu seem topographically to be quite general in the Red Sea off coasts and islands; there were also found many pinnacle reefs reaching sea-level. Sedimentation was found to be very small in all parts, so that the slopes were never masked.

Source of Copper in Ore Deposits

C. H. WHITE has recently discussed the concentration, distribution, and origin of copper ores in the earth's crust (*Economic Geol.*, **36**, 1; 1941). Although copper occurs in traces throughout the earth's crust, commercial deposits of copper ores occur only where the crust has been fractured by faults, fissures or shear. The ores are found in rocks of all types, sedimentary, igneous and metamorphic, and their deposition has especially followed periods of profound crustal deformation. Careful study has shown that deposits long thought to be magmatic segregations—like those of Sudbury—are in reality metasomatic replacements, genuine magmatic segregations, if any, being small and unimportant. It is known from observation that sulphides ascending from the depths are capable of replacing practically every other mineral in their path if conditions are favourable. Igneous intrusions do not occur in all copper districts. Where they do occur the usual sequence is (*a*) acid magma; (*b*) basic magma; (*c*) mineralization by copper sulphides. It is suggested that as the earth cooled to temperatures permitting chemical union of the atoms, the interaction of physical and chemical forces, notably gravity and the combination of the elements in the order of the heats of formation of their compounds, led to the concentration of copper and sulphur and of other similarly less chemically active heavy metals and their associated anions, to a zone underlying the silicate crust, where they remained until released by sub-crustal fractures. If fractures reach only to the level where acid magma is generated, granitic magma ascends; if they tap the basic zone, basaltic magma ascends; and only if they reach through to the sulphide zone do ores ascend. A similar hypothesis, based quite independently on the difference between the atomic weight of ore-lead and that of rock-lead has been proposed for lead ores by Holmes (*Econ. Geol.*, **32**, 782; 1932: **33**, 829; 1938).

Coupling of Diazonium Salts

A kinetic study of the coupling of diazonium salts with phenols made by Conant and Peterson in 1930 indicated that the measured rate was governed by an acid-base equilibrium in one or other of the reactants:

$$(1)\quad ArN_2^+ + OH^- \rightleftarrows ArN_2OH$$
$$(2)\quad ArOH \rightleftarrows ArO^- + H^+.$$

The conclusion was reached that the reaction was between undissociated phenol and undissociated diazo-hydroxide, the effect of alkali being to promote the reaction by increasing the amount of diazo-hydroxide. R. Wistar and P. D. Bartlett (*J. Amer. Chem. Soc.*, **63**, 413; 1941) have studied the coupling with aromatic amines, reaction (2) being replaced by

$$(3)\quad ArNH_2 + H^+ \rightleftarrows ArNH_3^+.$$

In this case the acid-base equilibrium reaches 50 per cent in the region of acidity corresponding with maximum velocity. There are four possibilities for the reaction: (1) diazo-hydroxide couples with the ammonium ion, (ii) diazonium ion couples with free amine, (iii) diazonium ion couples with ammonium

ion, (iv) diazo-hydroxide couples with free amine. A kinetic study of the influence of *p*H on the coupling of 1-naphthylamine-4-sulphonic acid and diazotized sulphanilic acid and of 1-naphthyl-amine-8-sulphonic acid and diazotized aniline was consistent with two mechanisms, but only one of these was in harmony with the facts regarding the activating and directive influence of aromatic substituents on the coupling reaction. It was thus shown that the active components in the coupling reaction are the diazonium cation and the free amine or phenoxide ion. C. R. Hauser and D. S. Breslow (*ibid.*, 418) also reach the conclusion that the diazonium ion is involved rather than the diazohydroxide, and show that this is in agreement with accepted electronic theories, the ion being an electron-accepting component and representable in two resonance forms.

Determination of Zinc in Magnesium Alloys and Zinc Alloys

E. Q. LAWS discussed the above at a meeting of the Society of Public Analysts and other Analytical Chemists held on February 5. The precipitation of zinc as sulphide from a buffered solution of formic acid and ammonium formate, investigated by Fales and Ware, is shown to afford a rapid and accurate means of separating zinc from a large excess of magnesium, aluminium, nickel, manganese and iron. Details were given of the application of the method to the determination of zinc (*a*) in synthetic mixtures, (*b*) in magnesium alloys containing 5–10 per cent of aluminium, 0·7–3 per cent of zinc and 0·5–1 per cent of iron, and (*c*) to copper-nickel-zinc alloys containing 20 per cent of zinc, 45 per cent of nickel, 0·5 per cent of manganese, 1 per cent of iron and the rest copper. With (*b*) it was found necessary to redissolve and reprecipitate the zinc sulphide; with (*c*) the copper was first removed electrolytically and a single precipitation of the zinc sufficed.

Origin of Transient Ionic Clouds

IN a theoretical note, P. M. S. Blackett and A. C. B. Lovell (*Proc. Roy. Soc.*, A, **177**, 183; 1940) suggest that the origin of some of the transient ionic clouds, generally assumed to be responsible for the low-level sporadic radio reflexions, may be due to large cosmic ray showers. Cascade cosmic ray showers of sufficient energy to produce some of these radio reflexions have been recorded, but the data are inadequate for a test of the theory. More suitable results could be got from the frequency-size distribution of the radio echoes observed from a horizontal or vertically directed beam.

X-Ray Crystallography and Chemistry of the Steroids

A COMPREHENSIVE survey of the X-ray crystallography of some eighty sterol derivatives belonging mainly to the cholesterol and ergosterol series but including also calciferol and other photo-derivatives of ergosterol and some higher plant and animal sterols has been made by J. D. Bernal, D. Crowfoot and I. Fankuchen (*Phil. Trans. Roy. Soc.*, A, **239**, 135; 1940). The crystallographic measurements are discussed in their bearing on specific chemical problems of characterization and identification, determination of molecular weight, the stereochemistry of the carbon skeleton, the effect of substituents on the crystallography of the sterols, a comparison of the crystallography of different sterols—monohydroxy compounds and the structure of calciferol. The survey illustrated very plainly the limitations of preliminary crystallographic study as a source of chemical information. Even in matters of straight identification, there may be difficulties where impure preparations consisting largely of mixed crystals or where polymorphic modifications are concerned. Exact X-ray analysis of carefully selected substances is proposed.

Stellar Colour Temperatures

IT is now recognized that the continuous radiation of the stars cannot be represented even approximately by Planck curves over all observable wavelengths. The recent discovery that negative ions of hydrogen may make an important contribution to the opacity of stellar atmospheres leads R. Wildt (*Astrophys. J.*, **93**, 47; 1941) to inquire whether the observed energy distribution curves can be reproduced from theoretical considerations, knowing the absorption coefficients of H and H^-, and assuming the absorbing atmosphere to consist of these particles only. He finds that this can be done tolerably well for early-type (*A*0 to *F*0) stars. For later spectral types, however, the predicted colour temperatures fall below the effective temperatures, whereas the observed values are much higher. Moreover, no addition of absorbing metallic atoms to the hypothetical atmosphere can improve matters, since metallic absorption in a late-type star rises steeply towards the violet, and therefore lowers the colour temperature still further. Thus it seems that yet another attempt to reconcile theoretical colour temperatures with observed values has failed. At present it looks as if further attempts will also fail unless they embody some hitherto unknown mechanism which produces an absorption coefficient decreasing from the near infra-red towards the violet.

Systematic Corrections to Proper Motions

W. M. SMART has discussed (*Mon. Not. Roy. Astro. Soc.*, **101**, 1) the "Systematic Corrections to the Proper Motions of the General Catalogue" more fully and accurately than previous investigators have done. It is pointed out that in the discussion undertaken by R. E. Wilson and H. Raymond (*Astrophys. J.*, **47**, 49; 1938) the elements of the solar motion, the precessional corrections and the constants of galatic rotation were derived from two solutions, one based on Schönfeld's equations in equatorial co-ordinates, and the second in galactic co-ordinates. As Miss Emma Williams has shown, however, the equatorial equations are incomplete so far as the rotational effect is concerned, because the double-wave term which depends upon Oort's constant, *A*, is omitted. In addition, some small adjustments were necessary owing to a misinterpretation of Schönfeld's notation and the omission of a factor. Smart points out also that the numerical formulæ which Wilson and Raymond have derived (*Astrophys. J.*, **47**, 57; 1937) for the systematic corrections to the proper-motion components are incomplete and do not fully satisfy the requirements of investigations dealing with small proper motions. In the present paper Smart applies the best available systematic corrections and derives the equations of condition for the elements mentioned above in literal form. Tables I and II supply the values of the corrections $\Delta\mu_\alpha \cos\delta$ and $\Delta\mu_\delta$, the unit being 0·01″ per century. Literal equations are also given when the solution is effected in galactic co-ordinates.

DEVELOPMENT OF THE FRONTAL BONES OF THE RAINBOW TROUT

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THE causes responsible for the development of the dermal bones of the skull in fishes have been the basis of much speculation by morphologists and palæontologists. Although this problem has been a popular one with workers in recent years, almost all the theories which have been formulated have been deduced either from purely morphological evidence or from abnormalities found in Nature, and so far as I am aware, the only experimental work of importance is that of Tatarko[1] on the opercular apparatus of the carp. His experiments, however, deal exclusively with the regeneration of bones and not with their development.

The experiments which are described below were undertaken by me with the object of throwing light on some of the more outstanding problems connected with the formation of the frontal bones in the trout. The method employed was a modification of that described by Hoadley[2] for Fundulus, in which pieces of embryos were removed through the egg-membrane by pricking with a glass needle and squeezing out the desired part by means of a small glass ring on a glass rod. Trout proved particularly satisfactory material for this work as they are very easy to keep alive, and do not require feeding until the yolk sac is absorbed, at which stage they are nearly fully developed. If necessary, however, they will readily feed and flourish on a little pounded liver. The trout used in the experiments were rainbow trout supplied by the Midland Fisheries, Nailsworth, Gloucester.

On theoretical grounds it has been suggested that the sense organs of the lateral line canal system of the head are important agents in stimulating bone formation in their vicinity. This view is based very largely on observations by Pehrson[3] on the development of the skull of Amia. Pehrson showed that those dermal bones which in the adult are connected with the lateral line canals start their development as aggregations of osteoblasts around certain of the sense organs of this system. The osteoblasts then give rise to small rudiments of bone around the sense organs, which may or may not in later development fuse with adjacent rudiments to form the adult bones. From this early association of the lateral line sense organs and certain dermal bones it has been argued that the former are the cause of the development of the latter. Many writers have attributed so much importance to this assumption that they have based their ideas of bone 'homology' to a great extent on it.

The experiments which I have carried out show that no such causal relationship exists. The rudiments of the lateral line canal system were removed from one side of the roof of the skull of an early trout embryo, shortly after the formation of the eyes. At this early stage no traces of sense organs or frontal can be distinguished in this region. The result of such an operation was to produce a fish in which the frontals were developed on both the right and left sides, but the frontal on the operated side, where there were no sense organs in its immediate neighbourhood, was rather less advanced in its development than that of the other side.

Similarly in fishes in which two or three sense organs and a piece of the canal are removed from the middle of the frontal region, the frontal develops normally, but the bony 'gutter' usually formed round the canal is absent in the region where the organs have been extirpated.

These two sets of experiments demonstrate conclusively that the actual origin of the frontals during development is due to some cause other than the presence of the sense organs of the lateral line canal. The lateral line itself appears only to be capable of stimulating bone formation in its own close vicinity, but not of initiating the appearance of a frontal.

Two further sets of experiments were carried out to demonstrate the influence of the brain on the development of the frontals. In one lot the greater part of the brain, namely, the forebrain, optic lobes and most of the cerebellum, was extirpated at an early stage, when the neurocranial part of the chondrocranium consisted only of trabeculæ, parachordals and the rudiments of the cartilaginous auditory capsules. The skull resulting from this brain removal consisted of fairly normal olfactory and auditory regions, but the intervening taenia marginales were fused into a continuous median rod leaving no cerebral cavity anteriorly to the auditory capsules. Nevertheless the frontals developed as paired bones. Their position relative to the taenia marginales and other cartilages in the neighbourhood, in which the frontals usually develop, was as nearly normal as possible. They were also connected with their appropriate lateral line canals, except of course in those cases where the latter had been removed. The operation of removing the brain obviously greatly reduces the quantity of tissue between the eyes, and the lateral line canals and the rudiments of the frontals lie relatively much closer together on top of the head. Thus the frontals have a very much smaller area to cover than normally, and it can be seen that the ossification around the sense-organs and canals is thicker and more advanced than in an unoperated animal of similar age.

These experiments demonstrate that the paired nature and origin of the frontals is not related in any way to the underlying brain. It is interesting to compare this artificially produced condition with that in microcephalic and anencephalic skulls in man. In these monstrosities the full complement of dermal bones is formed, but the brain-case is greatly reduced in size.

The second set of experiments consisted in removing the eye on one side of the embryo a short time after its appearance. As development proceeded the optic lobe of the unoperated side remained small, whereas that of the operated side, which innervated the remaining eye, increased in size at the normal rate of development. The greater part of the

frontals usually cover the optic lobes, and the bones of each side meet each other between the right and left optic lobes almost precisely in the middle line. However, in the operated individuals in which the optic lobes are unequal this relation between frontals and the brain no longer exists, each frontal growing towards the middle line of the head at more or less its normal rate. The frontal of the unoperated side thus comes to extend beyond the middle line of the brain over the optic lobe of the other side. From these experiments, therefore, it can be concluded that the median suture of the frontals is independent of the underlying brain. Although these results are such as would on general grounds be expected, they are opposed to the interpretation put by Troitsky[4] on his experiments with the dog's skull.

Although the experiments here described throw no positive light on the nature of the processes governing the initiation of ossification at certain definite places in a developing skull, they do much to dispose of some commonly held but erroneous views, especially those concerned with the lateral line canal. The repercussion of these conclusions on the method of homologizing dermal bones appears to me to be very important to morphologists generally, and will be discussed at length when this work is published in full.

[1] *Zool. Jahrb. Abt. alg. Zool.*, **53**, 461 (1934).
[2] *J. Exp. Zool.*, **52**, 7 (1928).
[3] *Acta Zoologica*, **3**, 1 (1922).
[4] *Z. Morph. Anthrop.*, **30**, 504 (1932).

PSYCHOLOGICAL ASPECTS OF COLOUR MEASUREMENT

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COLOUR STANDARDIZATION has two aspects which are of equal importance—the physico-chemical and the psychological. The work of Ostwald[1] has been severely criticized in NATURE by J. Guild with regard to its physico-chemical foundations[2]; with Ostwald's psychological and æsthetic considerations Guild refuses to deal, because "they have no relevance to colour measurement" (p. 272). To the psychologist, however, it is just these considerations which are of the greatest interest, particularly as the great success which the Ostwald system has had commercially both in Great Britain and in Germany indicates that the needs which Ostwald attempted to meet are very real needs among those who have to deal professionally with colours, coloured papers and the like. An examination of the claims advanced on behalf of Ostwald's "Colour-Science" in the psychological sphere may therefore not be out of place, especially at the present moment, when a *psychological* standardization, such as Ostwald attempted, may easily be of great importance in the practice of camouflage, where, as in pictorial art, human perception and not physical apparatus is the ultimate arbiter of colour and brightness equalities and differences.

The two main claims made by Ostwald with regard to his system are (*a*) that his eight standard greys, the differences between which are based on the Weber–Fechner law, are equidistant psychologically, and (*b*) that the twenty-four colours which go to make up his colour-circle are also psychologically equidistant. Several further claims are made with regard to the æsthetic qualities of certain relations obtaining between both the greys and the colours, the two main of which are (*c*) that triads made up of three greys the differences between which are equal according to his system are especially pleasing, and (*d*) that diads made up of two colours which are eight steps apart on his colour-circle are also especially pleasing.

These four claims were submitted to experimental tests, and the results are reported below. The materials used were the coloured papers produced by the W. Ostwald Farben G.M.B.H., and wherever possible the results were checked up with the dyed fabrics given in his book. (The papers are produced very carefully according to Ostwald's own formulæ, and give, as he himself acknowledges, a very good approximation to the colours intended. It would, of course, be preferable in some ways to work with coloured lights, but Ostwald is very emphatic in his assertion that his laws apply only to *reflected* light.)

(*a*) Ostwald's first claim was tested in two ways. (1) Twelve subjects were given seven cards on each of which two consecutive Ostwald greys were affixed, and asked to judge the amount of 'difference' of the two greys on each card as compared to the others by the method of paired comparison. The following results were reached:

Greys	Judged 'Larger than'	Judged 'Smaller than'	Judged 'Equal to'
a/*c*	93 per cent	0 per cent	7 per cent
c/*e*	38	13	49
e/*g*	37	18	45
g/*i*	33	17	50
i/*l*	33	18	49
l/*n*	3	85	12
n/*p*	0	86	14

The second test was carried out by means of a method suggested by Barnhart[3], and particularly well adapted to questions of this kind. (2) Ten subjects were asked to arrange rectangular pieces of paper, each cut from one of the eight greys, on specially prepared sectional paper in such a way that the distance on the paper was to be taken as an indication of the difference in brightness between them. The average distance for all the greys being put at 1·00, the average distances between any two consecutive greys were: $a/c = 1{\cdot}8$; $c/e = 1{\cdot}2$; $e/g = 1{\cdot}0$; $g/i = 0{\cdot}9$; $i/l = 1{\cdot}0$; $l/n = 0{\cdot}6$; $n/p = 0{\cdot}5$. Thus the two methods give much the same results: while the greys in the middle are more or less equidistant, grey *a* is too far away from grey *c*, and the last three greys (*l*, *n*, and *p*) are much too close together. This result is not unexpected in view of the results reported by Kŏnig[4], Burkamp[5] and others, with regard to the limited applicability of the Weber–Fechner law to brightness differences.

(*b*) A similar method was adopted in testing Ostwald's claim with regard to the colour-circle. Two concentric circles, of diameters 50 and 52 inches respectively, were drawn on white cardboard, and the ring between them divided into 48 equal parts. From the 24 Ostwald colours pieces were then cut out in the exact shape of the ring-segments, and laid on the ring in such a way that each piece was followed by a blank segment. Twelve subjects were told that the average difference between one colour and the next was represented by one blank space on the chart, and that if anywhere they noted that two colours were either too close together, or too far apart to be fairly represented by a distance of one space, they should change the distance until it represented as accurately as possible their opinion of the difference. The following table gives the average amount of change advocated, indicating both direction and size of the change. A + sign indicates that on Ostwald's circle the distance between the two colours is too small, and should be increased by the amount shown; a − sign indicates that the distance should be diminished by the amount shown.

Colours	Change	Colours	Change
1 and 2	−0·83	14 and 15	−0·50
5 and 6	−0·58	16 and 17	−1·00
7 and 8	+0·75	18 and 19	−0·92
12 and 13	+1·17	20 and 21	−0·25
13 and 14	+0·17	24 and 1	+1·58

It is clear that in view of these results the validity of Ostwald's claim must be seriously doubted.

(*c*) For testing Ostwald's third claim, eight grey *harmonies* were constructed in accordance with his specifications, and eight grey *combinations*, made up to contravene his principles. The size of the inequality in these combinations varied from 1 to 3 steps. The 16 triads were ranked in order of liking by six subjects, the average intercorrelation between them being 0·49. The average order of these subjects would correlate with the true order of the whole population of which they were only a sample to the extent of approximately 0·92 (footnote 6, and references); hence we may take their average ranking as a fairly close approximation to the 'true order'. On the average, the *harmonies* are ranked 8·7, the *combinations* 8·3; in other words, if anything the *combinations* are preferred. The best-liked triad is a combination, the least-liked a harmony. This adverse result seems due, however, not so much to any fault in Ostwald's proposed law, as rather to the inaccuracy of the spacing of the greys in his system; introspective evidence shows that the combinations and harmonies most preferred are those in which the differences are seen as equal.

(*d*) To test Ostwald's last claim, 48 diads were used. There are 24 diads which have a circle distance of 8 steps; in addition 12 diads were included with a circle distance of 5 steps and another 12 with a circle distance of 11 steps. Ten subjects arranged these forty-eight diads in order of liking, giving the following average number of points to each group (a scheme of grouping, closely following the normal distribution curve, was adopted in the ranking, as with 48 items the assumption of linearity implicit in the straightforward ranking procedure is likely to be false):

Circle distance, 5 steps: 3·8 points.
Circle distance, 8 steps: 4·5 points.
Circle distance, 11 steps: 5·2 points.

Thus on the average the greater the circle distance, the better liked were the diads. This finding bears out Kirschmann's First Law, namely, that "combinations are pleasant if they yield a maximum . . . contrast effect"[7]. Additional experiments, involving the ranking of the 24 constituent colours of the diads by the same subjects, also confirm his tenth law, namely, that "the pleasantness or unpleasantness of the single colours affects the pleasantness or unpleasantness of their combinations". The influence of these two factors seems to be about equal, each contributing some 25 per cent to the final ranking.

Thus here also, as in the previous experiments, empirical investigation fails to support Ostwald's claims. In spite of this disappointing conclusion, I believe that the main aims which Ostwald hoped to reach are eminently worth while, and that a repetition of his work with the proper statistical and experimental safeguards would lead to great progress in those applied arts and sciences which to some degree depend on colour, such as art teaching, poster designing and camouflage.

[1] Ostwald, W., "Colour Science" (London: Windsor and Newton, 1931).
[2] Guild, J., NATURE, **129**, 453 (1932).
[3] Barnhart, E. N., *J. Exp. Psychol.*, **25**, 506 (1939).
[4] König, A., and Brodhun, E., *Akad. Wiss. Berlin, Sitzber.*, **37**, (2), 917 (1888).
[5] Burkamp, W., *Z. Psychol.*, **55**, 2, 133 (1923).
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CONDENSING PLANT FOR POWER STATIONS

THE design of steam condensing plant and associated cooling water systems for power stations was considered from the economic point of view in a paper by W. T. Bottomley (Messrs. Merz and McLellan, consultants) submitted to the North East Coast Institution of Engineers and Shipbuilders at Newcastle-upon-Tyne on March 28.

Mr. Bottomley showed that the condensing plant should be designed to fit the circulating-water system, the ratio of the quantity circulating to the tube surface area depending on the length of the water system. Thus for a station close to the bank of a non-tidal river, the ratio should be considerably larger than when tidal water can be utilized. Data are included indicating the performance of the condensers at the Dunston "B" station of the North-Eastern Electric Supply Co., together with the results of cooling tower tests carried out at the Darlington municipal generating station.

Mr. Bottomley's deductions are that the economical water velocity through the tubes, the size of condenser, quantity of water circulating and size of cooling tower can each be determined independently of the others and depend on cost ratios, as does also the economical ratio of water to the surface in the condenser.

Under dirty conditions, the economical load on a condenser should be about 5,300 B.Th.U. per sq. ft. for base-load stations, instead of the generally recommended figure of 7,000. When the size of the turbine house building is fixed, it pays to install the largest condenser possible in the space available.

The relation between the normal vacuum in the condenser and the average temperature of the inlet circulating water has been practically fixed by convention. The sizes of condensers built in the United States are much the same as those built in Great Britain, but the quantity of water used is sometimes greater. Port Washington Power Station (U.S.A.) is the most efficient power station in the world. Monthly and yearly average operating figures are published from time to time. In 1937 the average load for the machines was nearly steady at 53,000 kilowatts. The greatest monthly average temperature rise of water, 4·2° F. above that of the circulating water inlet, occurred in March, and the smallest rise, 4·0° F., occurred in August. The temperature rise of the circulating water of about 4·0° F. shows that the quantity of the circulating water is nearly 250 times the quantity of the steam condensed. It has to be noted that whatever the conventions adopted twenty years ago, prices and conditions have now considerably altered. The most important of these is the average loading of the plant, which, especially in base-load power stations, is considerably higher now than ever before. The cost of fuel per kilowatt-hour has not materially altered. The fuel consumption per unit has been reduced to a half during the last thirty years. This has been offset to a large extent by the rise in the price of coal, which is now double what it was. When river water is used for cooling, the temperature of the water is the theoretical lower temperature of the cycle; for cooling tower schemes it is the atmospheric wet bulb temperature. In a given locality, these two temperatures on the average are about the same: for example, about 52° F. in Great Britain.

The approach of the condensing temperature to the theoretical temperature is limited by the question of cost, and the aim of the engineer is to design the plant so that the total annual cost including capital charges is a minimum. Mr. Bottomley shows mathematically that for conditions of minimum cost, the size of the condenser, the size of the tower and the quantity of circulating water can each be determined independently of the others, and this considerably simplifies the problem.

Among the important conclusions deduced is that the effect of deposit on the tubes can only be counteracted by increasing the tube surface and reducing the water velocity. No advantage is gained by increasing the quantity of the circulating water. Bearing in mind the cost of the circulating-water system and the cost of pumping, it is clear that the longer the circulating-water system is, the more the quantity of the circulating water should be reduced and the lower should be the normal vacuum in the condenser. Subject to the ground being suitable to bear the weight, power stations using tidal-river water cooling should be placed as near as possible to the river front, as this reduces the length and cost of the circulating-water system and also improves the overall efficiency of the station. By placing the station on the river front, a saving of about one per cent in the fuel consumption can be effected without reducing the distance between the intake and the discharge to the river, compared with a station placed about 800 ft. from the bank.

PLANNING IN GREAT BRITAIN

A CONFERENCE on National Planning arranged by the Garden Cities and Town Planning Association was held at Oxford on March 28–30. An abstract of the valuable survey presented by Dr. Dudley Stamp at the Conference has already appeared in NATURE of May 24, p. 647. In what follows, digests are presented of some of the other contributions.

Mr. D. E. Gibson's paper on problems of decentralization, central development and satellite towns, while outlining the plans adopted by the Coventry City Council as a basis for Lord Reith's investigation, was essentially a discussion of some of these fundamental problems. It is obvious that we must have an idea of the size of the city for which we are planning before any intelligent planning is possible, and this is true whether of amenity services or of such problems as transport and roads. Such a question can only be answered when national planning arrangements have been made. National planning by the Government, as Mr. Gibson points out, is vital, because such information is required by all planning authorities in the country.

The valuable reports of the Barlow Commission and of P E P (Political and Economic Planning) do not supply all the material that is required as a basis for legislation, though the Conference re-directed attention to them, and Mr. H. W. J. Hick in particular, in his paper on "The Machinery of Planning", urged the adoption of the findings of the Barlow Commission with the reservations and amendments of the signatories of the Minority Report. The field for further investigations, however, is admirably illustrated in some notes for discussion on planning principles by Mr. W. Harding Thompson, which formed one of the most valuable contributions to the Conference.

Mr. Thompson shows that while there may be general agreement as to the objectives of planning, and the argument for decentralization may be regarded as accepted as a basis of policy for the central planning authority, changes occurring during the War must be taken into consideration. Some war factories may form the nuclei for new industrial settlements, but the central authority must at least provide a general outline plan on very broad lines for national zoning of industry. This plan, moreover, must take account of the balance of community life as well as of other economic and aesthetic factors. Planned redistribution is probably best applied to the numerous light and mobile industries with their wide choice of location.

The unit of regional planning also requires consideration in the light of experience of the civil defence regions. Mr. Thompson throws out as one suggestion the formation of industrial and agricultural planning boards, and stresses the necessity of harmonizing conflicting requirements of various

Government Departments by the central or regional authority before transmission to local authorities, if local planning schemes are not to be delayed and confused. He reiterates with Mr. Gibson the importance of a local planning authority or joint committee deciding on the optimum size and population of a town before planning for increased industrial activity. Expansion beyond that size should be by means of adjacent satellite or independent new communities within the region, each surrounded by a green belt.

The question of the optimum size of towns is one of the major problems on which further research is required. Obviously it may vary in accordance with physical limitations, the character and function of the town, the labour conditions, possible services, strategic situation and population required to support cultural activities, etc., and the analysis in the PEP report requires extension to some practical conclusion. The maximum density of development for urban areas, especially in residential units, is another matter in which further guidance is required, while the relation of agricultural to other industries established in rural districts needs investigation in several respects. The possibility of a further decrease of agricultural workers in Britain after the War, due to scientific and mechanized methods of farming and as a part of Imperial agricultural policy, must be seriously considered both in its effect on the vitality and mortality statistics and in relation to food policy and possible changes in production such as extended market gardening. Equally we have to consider the possibility of stabilizing and revitalizing rural community life by the introduction of selected light industries in villages, and the ways and means of safeguarding the benefits in health which have already flowed from the closer contact through evacuation of town workers with rural life.

Prof. J. H. Jones advocated the immediate establishment of regional boards, under the chairmanship of the Civil Defence Commissioners, to control the location of industry, and urged that the Government should decide whether the present Ministry of Works and Buildings is to be the effective Ministry of Reconstruction or to be superseded. Dr. Robson, in stressing the advantages of immediate planning to the war effort, holds that industry is capable of more control in its location than Prof. Jones suggested.

There can be no doubt that there are wide fields in which the planning of post-war Britain and the research and technique involved in reconstruction could be undertaken now with direct advantage to our war effort, apart altogether from the effect on public morale. There is much educational work to be undertaken, not merely of the general public, but also post-graduate education in such fields as organic planning, quantitative study of zoning areas, factory-building, shopbuilding, leasing and rent-fixing, control of use and design—aspects and techniques of town-building which, as Mr. F. J. Osborn pointed out, are not adequately covered in present town-planning education. There is also the vital contribution of the Building Research Station in regard to the use of new materials of construction as well as in matters of design, and here again research must be linked up with the development of new techniques and much far-reaching educational work.

CRUSTAL STRUCTURE OF NEW ZEALAND

K. E. BULLEN states that the progress of instrumental seismology has been slower in New Zealand than in a number of other earthquake regions, and it was not until the present decade that the identification of phases other than the normal P and S could be made in the records of near earthquakes (K. E. Bullen, "The Crustal Structure of the New Zealand Region as inferred from Studies of Earthquake Waves", Proc. Sixth Pacific Science Congress, 1939). The subsequent studies of the crustal structure of the New Zealand region have been subject to a number of special difficulties, of which some, but not all, have since been resolved or modified.

These difficulties centre chiefly around the considerable uncertainties in the determination of epicentres and origin times of many of the earthquakes which have shown phases in addition to P_n and S_n. Epicentres are in general best determined from the absolute arrival times of P_n at a sufficient number of stations, but until recently Wellington and Christchurch were the only stations the absolute time of which could be relied upon for such a purpose. This has necessitated recourse to $P_n - S_n$ intervals with the attendant difficulties of the accurate identification of the onset of S_n. There were doubts also concerning the normal P velocity immediately below the crustal layers, and therefore by implication in the corresponding S velocity also. A step forward was taken by Bullen when the significance of the phase S^* was recognized in New Zealand earthquakes, following a study of the aftershocks of the Hawke's Bay earthquakes of February 2, 1931. It would appear that S^* has been recorded more often than any other phase in New Zealand and that S^* may sometimes be recorded when the normal S_n is completely missed. A revision of the analysis of the Wairoa earthquake of September 15, 1932, and of the Pahiatua earthquake of 1934 has led to further improvement. Statistical methods have been used wherever possible.

The new epicentre of the Wairoa earthquake was considered so satisfactory that new travel-time curves were prepared which, Bullen believes, approximate to the best results obtainable for the New Zealand region on the data so far available. The data refer particularly to that part of New Zealand which lies between latitudes 38·5° S. and 43·5° S. From these data P^* up to 4° has a velocity of 8·1 km./sec. though the normal 7·8 km./sec. fits nearer 6°. There are signs that P^* is double with velocities 6·55 and 6·0 km./sec. $P_{3\cdot0}$ and $S_{3\cdot0}$ have additionally been recognized, the former making S_n difficult to recognize at some stations. $P_{5\cdot0}$ has also been recognized by geophysical prospectors in New Zealand and may correspond to travel paths through greywacke, which occurs abundantly in the region between Wairoa and Wellington.

In conclusion, it is suggested by Bullen that the structure may be: (1) uppermost layer, perhaps a greywacke for a good part of the region, thickness 5–10 km. with velocity of P 5·0 km./sec. and S 3·0 km./sec.; (2) granitic layer, 4 km. thick with velocity of P 5·5 km./sec.; (3) intermediate layers, 10–20 km. thick altogether with velocities of P 6·0, 6·3, 6·5 and 7·0 km./sec. and in the lower

part S 3·7 km./sec.; (4) lower layer dunite with base uncertain, velocity of P 7·8 (?) km./sec. and S 4·4 km./sec. This varies somewhat from the European structure, chiefly in having a thinner granitic layer and a thicker intermediate layer than Europe. The phase $P_{g\cdot g}$ may correspond to the phase P_Y in California, and it is suggested that there may be some resemblance between the crustal structures of New Zealand and Japan.

PLANTS USEFUL AND ORNAMENTAL

UNLESS he be a professed systematist, the modern botanist, newly arrived in the tropics, as also the horticulturist and agriculturist, may well find himself bewildered and dismayed, as well as bewitched, by the diversity and profusion of the vegetable forms which everywhere greet the eye. Those first encounters, indeed, provide a pleasure not entirely devoid of pain; they force a realization of the small knowledge that one so often brings to a vast subject. Such local works as afford simple and direct guidance in the identification of the more common genera and species are therefore of great value and should be appreciated accordingly.

In this category is the volume just issued by R. O. Williams and R. O. Williams, jun. ("The Useful and Ornamental Plants of Trinidad and Tobago", third edition, Government Printers, Trinidad), the original edition having been published by W. G. Freeman and R. O. Williams in 1927 and a second in 1928. The object, in the first instance, was to give information about native and introduced plants possessing interest because of their useful and ornamental qualities. Actually, a brief random sampling shows that the title errs on the side of modesty, for many plants, not essentially useful or ornamental, but of considerable botanical interest, are also described—a feature not only desirable in itself but also one which lends a fullness to the work.

The Colony, as the authors state, possesses many wild plants, prized for their economic or decorative value; and many plants have been successfully introduced from all parts of the world. "To obtain information on many of these is often difficult, even in a well appointed botanical library, entailing search through various standard works of reference, and often the agricultural, botanical and other publications of several other countries. To the person not so equipped the task is frequently a hopeless one." Thus appreciating the need, the authors have successfully fulfilled their task. In this edition the lists of useful plants have been completely rearranged and keys have been provided to facilitate identifications. Cultural notes make a useful addition to plant descriptions and notes on crop plants have been brought up to date.

It is a pleasant occupation to make an excursion at random through such a work, where East meets West and where the denizen of the high woods comes to rest by the side of more everyday garden staples, but for the botanist the features of greatest interest are perhaps those sections where orchids, ferns, grasses, cycads, conifers, cacti and mangroves are treated as groups. At a glance the wealth of the Islands can be seen. Further, what is true of the major groups is true of the flora as a whole; the number of native and introduced plants possessing particular interest is surprising.

FORTHCOMING EVENTS

Thursday, June 5

ROYAL SOCIETY OF MEDICINE (at 1 Wimpole Street, London, W.1) at 5.30 p.m.—Prof. Julian Huxley, F.R.S.: "Art as a Social Function" (Lloyd Roberts Lecture).

CHEMICAL SOCIETY, INSTITUTE OF CHEMISTRY, and SOCIETY OF CHEMICAL INDUSTRY (Joint Meeting in the University Chemical Department, Bristol) at 6.30 p.m.—Prof. G. M. Bennett: "Liquid Crystals".

APPOINTMENTS VACANT

LECTURER IN MECHANICAL ENGINEERING—The Principal, Aston Technical College, Whitehead Road, Birmingham 6 (June 7).

LECTURER IN PHARMACY and LECTURERS IN MECHANICAL ENGINEERING—The Principal, Central Technical College, Suffolk Street, Birmingham 1 (June 7).

SENIOR LECTURER IN THE DEPARTMENT OF ELECTRICAL ENGINEERING—The Principal, Heriot-Watt College, Edinburgh (June 9).

REPORTS AND OTHER PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

Annual Report of the Oundle School Natural History Society. Pp. 20. (Oundle: Oundle School.) [55

Scientific Proceedings of the Royal Dublin Society. Vol. 22 (N.S.), No. 38: The Vitamin D Requirements of the Growing Pig. By Brendan J. Senior. Pp. 379–386. 6*d*. Vol. 22 (N.S.), No. 39: Studies on the Oxidising Action of Selenious Acid. 1: Organic Sulphur Compounds. By A. E. A. Werner. Pp. 387–392. 6*d*. (Dublin: Hodges, Figgis and Co., Ltd.; London: Williams and Norgate, Ltd.) [55

Catalogue of 20,554 Faint Stars in the Cape Astrographic Zone −40° to −52° for the Equinox of 1900·0 giving Positions, Precessions, Proper Motions and Photographic Magnitudes derived from Photographs taken at the Royal Observatory, Cape of Good Hope, under the direction of Dr. H. Spencer Jones and Dr. J. Jackson; also Spectral Types classified from Plates at the Harvard College Observatory, Cambridge, Mass., U.S.A., by Miss Annie J. Cannon. Pp. lvii+414. (London: H.M. Stationery Office.) 42*s*. net. [75

Observations made at the Royal Observatory, Greenwich, in the Year 1936, in Astronomy, Magnetism and Meteorology, under the direction of Dr. H. Spencer Jones. Pp. vii+A78+B16+Cix+161+D66+E46+38. (London: H.M. Stationery Office.) 35*s*. net. [75

Reports on Progress in Physics. Vol. 7 (1940). General Editor: J. H. Awbery. Pp. iii+362. (London: Physical Society). 22*s*. 6*d*. net. [135

Other Countries

Annals of the Carnegie Museum. Vol. 28, Art. 12: A New Crocodilian, *Hassiacosuchus kayi* from the Bridger Eocene Beds of Wyoming. By Charles C. Mook. Pp. 207–220+plates 23–25. (Pittsburgh, Pa.: Carnegie Museum.) [75

Smithsonian Miscellaneous Collections. Vol. 99, No. 21: A New Shipworm from Panama. By Paul Bartsch. (Publication 3632.) Pp. ii+2+1 plate. (Washington, D.C.: Smithsonian Institution.) [85

Smithsonian Institution. Explorations and Field-Work of the Smithsonian Institution in 1940. (Publication 3631.) Pp. v+100. (Washington, D.C.: Smithsonian Institution.) [85

Annual Report of the Director of the Japan Institute for Science of Labour for 1939. By Dr. G. Teruoka. Pp. ii+14. (Tokyo: Japan Institute for Science of Labour.) [85

United States Department of the Interior: Fish and Wildlife Service. Wildlife Circular 6: The House Rat. By James Silver. Pp. iv+18. (Washington, D.C.: Government Printing Office.) 5 cents. [95

University of Bombay: Department of Chemical Technology. Annual Report, 1939–40. Pp. 28. (Bombay: The University.) [95

Imperial Council of Agricultural Research. Scientific Monograph No. 14: Further Studies on Cereal Rusts in India. By Dr. K. C. Mehta. Pp. vii+224+12 plates. (Delhi: Manager of Publications.) 6 rupees; 9*s*. 6*d*. [95

Memoirs of the Geological Survey of India. Vol. 63, Part 3: The Stratigraphy of South Singhbaum. By Dr. J. A. Dunn. Pp. iv+303–370+ix+plates 33–37. (Calcutta: Geological Survey of India.) 1.14 rupees; 2*s*. 9*d*. [95

Publications of the Observatory of the University of Michigan. Vol. 8, No. 5: The Spectrum of Nova Cygni III (1920). By Ralph B. Baldwin. Pp. 61–94+2 plates. Vol. 8, No. 6: The Francis C. McMath Memorial 24-inch Reflecting Telescope of the McMath-Hulbert Observatory. By Robert R. McMath. Pp. 95–102+6 plates. Vol. 8, No. 7: Dimensions and Shape of the Andromeda Nebula. By Robley C. Williams and W. Albert Hiltner. Pp. 103–106+1 plate. (Ann Arbor, Mich.: University of Michigan.) [95